DOCUMENT RESUME

ED 082 651 HE 004 677

AUTHOR	Welch, James A.
TITLE	Report on the Information Management Training Institute, Summer 1972.
INSTITUTION	Institute for Services to Education, Washington, D.C.
SPONS AGENCY	Meharry Medical Coll., Nashville, Tenn.; Tennessee State Univ., Nashville.
PUB DATE	Aug 72
NOTE	100p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	Conference Reports; Data Analysis; *Data Collection; *Higher Education; *Institutes (Training Programs); *Management Information Systems; *Management Systems

ABSTRACT

Sessions of the Information Management Training Institute, sponsored by Tennesses State University and Meharry Medical College, are presented in this report. Presentations are divided into five sections: data collection, data manipulation, remote data access, reporting, and team presentations. The first section emphasizes data collection and analysis for higher education and the college accountability/grading/information system (CAGIS). The section on data manipulation presents a brief discussion of statistical indicators and a data preparation and analysis workbook. The third section on remote data access concerns remote operation of a time-sharing computer. Management reporting, discussed in the fourth section, emphasizes establishing goals and objectives, developing the system, implementing the system, schedulting and planning, and evaluating and maximizing performance. Three flip charts are displayed in the team presentations. (MJM)

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REPORT ON

THE INFORMATION MANAGEMENT TRAINING INSTITUTE

SUMMER 1972

INSTITUTE FOR SERVICES TO EDUCATION, INC.
MANAGEMENT INFORMATION SYSTEMS DIRECTORATE
2001 S STREET, N.W., WASHINGTON, D.C. 20009

HE 004 627

ED 082651

REPORT ON THE INFORMATION MANAGEMENT TRAINING INSTITUTE SUMMER 1972

Sponsored by
Tennessee State University & Meharry Medical College
Nashville, Tennessee
July 10-21, 1972

Prepared by

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2001 S Street, N.W. Washington, D.C.

August, 1972

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ACKNOWLEDGEMENTS*

The idea of an Information Management Training Institute was conceived by and developed under the guidance of the Management Information Systems (MIS) Directorate of the Institute for Services to Education, Inc. in conjunction with TACTICS (Technical Assistance Consortium To Improve College Services.) MIS gives special thanks to the discussion leaders of the Institute, who in addition to leading the group sessions, also contributed to the development of the lecture materials included herein. They are as follows:

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ACKNOWLEDGEMENTS

An Institute cannot be conducted without the participants, therefore we wish to extend our appreciation to those persons, representing the TACTICS institutions, who participated in the Institute.

Thanks also go to the MIS staff, Sondra Ferguson, Linda Jackson, Osborne Lee and Gloria Lowe who worked tirelessly during the development and implementation stages of the Institute and special thanks to Linda Jackson for assistance with the editing and offering of suggestions related to the composition of this document.

*Funding for this institute was made available under Section V-E of the Education Professions Development Act through the U.S. Office of Education, Department of Health, Education and Welfare.

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PREFACE

The Management Information Systems Program of the Institute for Services to Education is designed to improve the information handling (management) procedures in developing institutions. This program is under a larger project, acronymically referred to as TACTICS (Technical Assistance Consortium to Improve College Services). The Information Management Training Institute, sponsored by Tennessee State University and Meharry Medical College for the fiscal year 1972-1973, was funded under an EPDA V-E grant from the U.S. Office of Education. Its main purpose is to provide training to TACTICS college administrators for improving their college's internal information management procedures. The following is a description of the Institute as it is designed and the narrative outline which follows, conforms to the divisions of the main two-week summer portion of the Institute. [Two, two-day in-service training sessions are also a part of the overall program.]

A Management Information System is defined as a systematic procedure for collecting, storing, manipulating and disseminating information in any particular environment. The essential word components of this definition were incorporated into the format of the Summer Institute's training sessions.

The first day's session dealt with the techniques of data collection. The second with automated, as well as manual means of storing and manipulating collected data. The third day's session dealt primarily with the state of the art of collecting, manipulating and storing data utilizing the computer through remote access devices—teletypes. The fourth session dealt with how the collected and manipulated data may be interpreted and reported in a useful fashion in the particular environment in which we are operating—the college community. The final day allowed the participants to present their particular understanding of how an information systems design would apply to their individual institution(s). They made presentations in flip-chart fashion to an audience of fellow participants.

Organization of the Institute

The participants in the program were compartmentalized according to their administrative responsibility. Group A consisted of computer center personnel and institutional researchers; Group B—registrars, admissions officers and financial aid officers; and Group C was composed of business managers, fiscal and development officers.

The rationale for this grouping was similarity of administrative orientation, as well as function, thus facilitating a base for information exchange and comprehension. There were occasions where these groups were combined so that the exchange of ideas and particular administrative concerns could be aired in a classroom setting, but for the most part, the groups were maintained. In as much as the purpose of the Institute was to allow the administrators to comprehend and begin to formulate a design of a system that would be useful to the particular institutions which they represented, it was necessary to construct teams, across group lines such that the component parts of a college environment would be represented. Into this team structure was introduced a problem. This problem was the common thread—for the Institute's sessions—which combined the various skills of the administrators resident on the teams with the information imparted during the various sessions.

The Problem

The problem provided an array of situations–problems–which small, medium and large institutions face in the handling of information in their particular setting. The resolution of the problem could only be accomplished by the team's development of an information system that would work in the environment created by the "DATA SET", accompanying the problem. This Data Set contained scattered pieces of data–data elements–which were enough to give a team the necessary institutional characteristics of a small or medium-size college or university in the U.S.A. This information structure-system-should be developed by the administrator-team-of the hypothetical institution, such that the procedures for resolving the individual problems–in the problem statement–would not have to be reconstructed on *each* occasion when similar institutional dilemmas arise. The procedural, as opposed to the individual, handling of management problems is the preference of any information structure. Duplication of management efforts is reduced and efficiency for management operation is enhanced as the information structure evolves and environmental-institutional-policy is made congruent.

The participants were asked to organize the techniques imparted during the classroom sessions and to apply the problem elements as a guide in diagramming an information system. This system, once diagrammed, was formally presented, in flip-chart fashion, on the last day of the training institute to the assembled participant/instructor group. In an effort to inject more realism into the presentation, each team was told that they were to act as though the audience is the board of trustees of their institution, and that the board had requested of the president that such a presentation be made.

Summary of the Presentation

The concept of a centralized data bank–a location in the environment which would have the primary responsibility for storing and disseminating all of the institutionally pertinent data–permeated each of the presentations. If a single point of interest during the presentations can be sighted, it was that the data bank functioned as the catalyst for institutional organization. Although in no instance was an explanation given for the organization of such a bank, the diagrammatic symbol and concept dominated each presentation.

Another interesting point was the manner in which the various teams viewed the relative importance or unimportance of their institutions administrative areas and their responsibility for reporting data to the data bank and obtaining information from it. For example, in some presentations, emphasis was slanted toward the *business office functions* of a college. Upon review of the institutional characteristics of the members of those teams which presented this approach, we found that the greater percentage of them had the service of a computer. Though the computer is no shibboleth for the presence of a "good" information system, it was interesting to note the consistency of this approach to a report which the MIS/ISE Office sent to the TACTICS colleges in January of 1972. In this report, a point was highlighted, which revealed that of the forty-one (41) computer configurations existing at that time in TACTICS institutions, an average of 80% of the computer time contributed to the maintenance of *business office* type functions. Other team presentations distributed much more equitably, the responsibility for data coming in and information going out of the data bank.

Participants, through teams discussing ways and means of resolving college and university management problems, gained more appreciation for the "other administrative" point of view. This particular point came out during one discussion which we feel bears repeating, due to the significance it has for future institutes.

Management seminars, or training sessions for college administrators, often group *like* managers for ease of organizing and communicating esoteric information. This type of session is useful initially but where it falls short is that it has to *simulate* other management operations to function in a model situation. Seldom do these simulated management operations exist. Sessions such as these cannot simulate, for example, the

personalities of managers, which is an essential ingredient in any management problem. Though varieties of "other management problems" may be designed to function in a model, the actual is always preferred to the simulated. It was possible in the MIS/ISE Summer Institute to have the actual represented, and in the main, have most front-line–business, admissions and records, institutional research, etc.–areas resident on a team. The discussions and subsequent information handling approaches evolving from these discussions focused on problems no different than ones each of the participants faced daily in their various jobs, but according to reports, carried enhanced meaning because they "came from someone else". This type of statement carries strong indication that personalities are more a part of management procedure than one may be willing to admit.

The structural and analytical procedures of the environment are paramount for the design of a useful information management structure. The design, therefore, must take into consideration the policies of the structure, the peculiarities of management procedure, and the level of expertise of its administrators. Where the identification of these three is not obvious, training is necessary.

In the following pages, we have consolidated the lecture materials that were presented and used during the Summer Institute of the Management Information Systems Training Institute by the various participating discussion leaders. In some instances, the lecture materials have been edited such that the enclosures distributed during class sessions more closely parallel the narrative.

Section I
DATA COLLECTION

Abstract

The Data Collection session focused upon defining the purpose(s), procedures and overall science of data collection and analysis. The institution must make certain decisions concerning the objectives for collecting data and keeping these stated objectives in mind, discussion on the design of forms—one specific tool used for the collection of data—evolved. Attention was also given to the analysis, evaluation, interpretation and review of the collected data. Consideration of the theories of Data Collection are given in the first set of lecture materials included herein, entitled "Data Collection and Analysis for Higher Education."[1]

Particular attention was given in this session to a case study (including samples of forms) of one particular historically Black institution of modest enrollment. Points brought out in this report, as well as the sample forms, were reviewed and revised for classroom application. The text of this CAGIS ("College Accountability/Grading/Information System")[2] *report follows "Data Collection and Analysis for Higher Education" mentioned above.*

DATA COLLECTION AND ANALYSIS FOR HIGHER EDUCATION

by

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INTRODUCTION

A Parable of Three Little Turtles

Why should you believe anything I tell you? In turn, why should I believe you? In fact, why should you and I or any of the people associated with the institutions we represent believe anyone else? Haven't we been hurt often enough? Haven't we been let down too many times in the past? Why should we trust another? Can we believe even our friends? There is a parable of three little turtles which reveals something about the nature of trust and trusting.

Once there were three little turtles. They started out one summer afternoon for a country picnic. One carried a basket with sandwiches, relishes and desserts. The second, a jug of turtleade. The third—nothing. Just as they started they felt the first splash of raindrops on their shells.

"We can't have a picnic without an umbrella," said the first. "Who will go back for one?"

They quickly odd-manned and the empty-handed one was chosen.

"I won't go," he said. "As soon as I leave, you will eat all the food and drink all the turtleade and cut me out of everything, right?"

"Wrong," they said. "We'll wait for you no matter how long!"

"No matter how long?"

"No matter how long."

At last he turned back and they sat waiting. One hour, two, four . . . two days, a week. Two weeks went by when one turtle turned to the other to say, "Maybe we should go ahead with the picnic?" Just then the voice of the third little turtle came from the bushes behind them, "If you do, I won't go," he said.

We act like this sometimes too, don't we, protecting ourselves against disappointment? We buttress ourselves against being turned down. We withdraw into ourselves hardly daring to venture out and trust. A key question for all of us is: Do we dare to trust others? This matter of trust is central to any consideration of data collection for institutional research in higher education.

Some Definitions

institutional Research

In the broadest sense institutional research includes the whole spectrum of research in higher education. For the narrow and limited purposes of this discussion of data collection, however, institutional research means:

- The systematic appraisal and evaluation of the processes and operations of institutions
- With a view toward informing the policy formation and decision making processes of college or university administration and governance.

A Self Study

A self study is a comprehensive, introspective analysis of an institution:

- Where has it been?
- Where is it now?
- Where would it like to be?

The normal end product of a self study involves the preparation of a master plan.

A Master Plan

A master plan is the normal end result of a self study. It provides a good way to initiate program budgeting which becomes a continuing process.

Program Budgeting

Program budgeting is a special case of systems analysis. It involves the grouping of activities by programs whose resources and costs can be assessed and whose benefits or contribution to the institution can be identified. Program budgeting proposes that the costs and benefits of any program be compared with those of every other program on a continuing basis.

THE SCIENCE OF DATA COLLECTION AND ANALYSIS

Data Collection in a Policy-Making Environment: A Framework for Analysis

Contemporary decision theory offers a framework for organizing institutional research through:

- Identification and definition of the problems and issues.
- Collection of data related to specific problems and issues. (This includes data on values, preferences and attitudes.)
- Analysis of problems in the light of available data.
- Evaluation of alternative solutions or courses of action.

A key question for our consideration is: How can management tools and approaches for data collection and analysis be of value to educational leaders, especially in higher education? Although educational objectives are seldom clearly known and well stated, quantitative analysis can prove valuable in permitting us to learn about objectives. One of the chief objectives of quantitative analysis is the identification and definition of objectives. It is important for us to examine objectives critically and professionally as we look at our research conceptual and structural models. While it may prove necessary to begin with tentative objectives, we have to prepare ourselves to modify or replace them as we learn more about the institutions and systems under study and related institutions and systems. In many instances the feedback on objectives may be the most important results of the studies we undertake. So often objectives have not in fact been agreed upon. Even where the choice appears to be between alternatives it is often really a choice between objectives and ends. In this case, leadership must use non-analytic methods to secure final reconciliation of conflicting viewpoints.

Program Planning and Budgeting Systems (PPBS) present a direct challenge to the general decision-making machinery of institutions. Unlike the traditional administrative functions of accounting and inventory control, program budgeting and systematic analysis question institutional objectives by probing the purposes of institutional activities. They also serve the function of engaging the chief executive officer in dialogue designed to assess the practical and political feasibility of stated institutional objectives.

Under ideal conditions program budgeting arrays all the capital and operations cost associated with the orchestrating of personnel, equipment, facilities, and all other resources in the achievement of a specific quantified objective of the institution. Even in the absence of specific and quantified objectives program budgeting still permits a decision-maker to examine the total cost for comparable alternatives projected for the moment and into the foreseeable future. If the analysis includes political and social costs and benefits as well as the usual economic costs and benefits then the decision-maker has most of the information he needs to choose one of the alternatives. Yet quantified systematic analysis goes a step further in generating new and better alternatives. While program budgeting enables a leader to compare various alternative policies, the generation of new alternatives structured by the framework of program classifications is left to the imagination and creativity of the management analyst.

Data Collection for Management Information Systems Analysis

Planning Programs and Budgeting Systems (PPBS) represent a special case of systems analysis. The major steps in the process of program budgeting, for example, include:

- The establishment of goals and objectiv
- Development of alternative programs that will accomplish the same goals.
- Estimation of resource requirements for each alternative.
- An estimate of benefits to be gained from each program alternative.
- Development of an operating plan by selecting from among alternatives.

- Testing the long-range fiscal implication of the operating plan.
- Preparation of the annual budget.
- Evaluation of the program's success.
- Revision of planning standards.
- Repetition of the program-budgeting cycle to accommodate changes in objectives, goals, available resources and the institution's operating environment.

Analysis, Evaluation, Interpretation and Review of Data

The evaluation of information in the light of competing values, preferences, attitudes, goals and objectives makes an institutional research study meaningful and useful. It permits assessment of the vital "benefits" side of a cost-benefit equation. This is particularly important with regard to fiscal management. Too often on small college campuses the least cost criterion prevails when only the cost side is revealed in "hard" quantitative data. In the absence of an adequate evaluation of qualitative, often intangible benefits, resource allocation is little more than bookkeeping.

Some Conclusions

What are some of the conclusions we can reach concerning the evaluation and review of information?

In the application of an analytical framework to the decision-making research process it is possible for you as the management analyst to bring to the surface submerged institutional goals, objectives and longer range perspective. This means that you must first prepare a statement of explicit assumptions about objectives and priorities. Then, as these assumptions are debated, accepted, acted upon, revised or rejected, the objectives of a specific policy will tend to take clear shape. In this process the criteria for setting institutional priorities on a variety of other issues will begin to emerge.

The role of institutional research is to help clarify the direction in which the institution is moving. It raises questions concerning where the institution ought to be going. It provides a basis for development of priorities in terms of an array of institutional objectives and plays a major role in seeking objectives. The management analyst has the obligation to understand the politics of institutional management and to apply rationality to the process of policy making. Although it may not be possible to create a grand consensus on institutional goals and priorities simply through the conduct of institutional research, it is clear that institutional research and analysis that merely looks back to describe what was, without placing its findings in the context of the future, is incomplete and inadequate.

Institutional leaders and managers in the field of higher education have begun to turn to PPBS and the analytical tools of modern management for assistance in the face of complex and expensive educational organizations. These quantitative techniques promise to:

- Rationalize institutional planning processes.
- Provide a communications link between leaders and managers, students and faculty, and administrators and staff.
- Stimulate an intellectual climate of debate and discussion on central issues.
- Ultimately allocate scarce human physical and fiscal resources in a more efficacious way.

None of the available quantitative tools or models addresses all the problems facing institutional administrators today. There are several reasons for this. Analysis costs money and in the short run costs more money than not doing analysis at all. Educational administrators do not really know either what to expect or demand from quantitative analysis or how to respond to demands on their management analysts and institutional researchers. Analysis runs counter to many long established academic traditions. Currently, many administrators feel threatened by the new words and computers.

There are diminishing returns to program budgeting. The cost of management information systems is great. A research staff may do analysis with no one listening. Decision makers and this staff, who work in support of decision-making functions, must develop sustained communication. The decision maker cannot abdicate his responsibility to research staff members. To be effective, research staff assistance must be pertinent, helpful and timely. A need exists to arrive at reasonable levels of data collection and analysis and to insure that the information is making a genuine contribution to the institution's decision making.

In the future, institutional research will focus on the analysis and interpretation of major trends and perspectives in relation to their implications for and impact upon such matters as curriculum, governance, facilities, finance, institutional objectives and priorities. Institutional research in the future will not be known for its ability to sort out the complexities of space allocation, its statistics on student body geographical distribution and the religious affiliations of students, nor for its recommendations on managerial options for controlling campus disruptions, fiscal efficiencies, image polls and administrative propaganda. The greatest need is for a future orientation in the determination of institutional priorities and management objectives.

MANAGEMENT AS A FORM OF ENGINEERING

Some General Guidelines for Persons Engaged in Solving Problems of An Operating Institution

A person who engages in management analysis or who conducts institutional research should seek to apply the scientific approach to his work. This means being explicit, open and objective. He should take a broad and disinterested view and become thoroughly familiar with all aspects of the institution's operations relevant to the problem as well as outside forces that affect it. He should be responsive to evidence secured as a result of study and apply the most modern knowledge, approaches and techniques of analysis to problems. While seeking to avoid known pitfalls in the conduct of research, he should consider alternative approaches to the problem. He should seek to secure access to all information that can reasonably be thought useful in solving the problem. He must scrupulously observe all ground rules about confidentiality and secrecy as may be required by institutional policy and circumstances. It is his job to report the results of study to only those who sponsor the research unless specifically directed by them to report to a wider audience. While keeping those requesting or sponsoring a study as fully involved and informed on the work as reasonable and feasible throughout its duration, the management analyst must always keep in mind that in many complex institutional situations a study may shed light only on a part of the total problem.

In initiating an institutional study or survey, a management analyst should:

- Collect data and information adequate to provide the initial framework of the study.
- Exercise great care in defining the issue or formulating the problem with a view to the institution's needs and requirements.
- Use imagination and give careful attention to detail in setting forth alternatives for examination in the study.
- Acknowledge explicitly the uncertainties associated with the problem.
- Appreciate and understand the subjective as well as the objective aspects of the problem.
- Develop appropriate standards and criteria on the basis of which the study can be evaluated.
- Define the limits of the proposed study so that everyone involved can have a clear idea of what will not be done as well as what will be done.
- Realize that many of the factors involved in the initial phases of the study may have to be revised as the study proceeds and new knowledge surfaces.

As the management analyst moves from the initial stage of organizing a study or survey and begins to conduct his research he should take the following steps:

Assemble relevant data and information of verified reliability or, if such information is not available, assemble data of judiciously and suitably estimated unreliability so impacts of uncertainty can be assessed.

- Apply the best technical tools or relevant models he can develop or choose to the problem at hand.
- Seek a reasonable balance between the demands of the problem and a reasonable economy of effort.
- Employ appropriate checks for accuracy wherever possible.
- Check the sensitivity of the results to variations and assumptions and inputs, especially to uncertainties.
- Keep in mind the need for a continuing reassessment of assumptions and formulations, changing them and modifying the analysis as necessary.

In order to assure that his study and its findings are well communicated, understood and acted upon, a man-

agement analyst should use a simple and clear vocabulary free of jargon. He should report clearly, giving: 1) the key assumptions used; 2) major alternatives considered; 3) the essentials of data used; 4) the criteria used for selecting data; 5) findings in the light of realistic changes in assumptions or uncertainty in the data; and 6) their implications for policy and action. He should explain conscientiously what the study accomplished as well as what was not considered or accomplished. Considerable attention should be given to a statement of the limitations on methodology or conclusions that should be observed. Similarly, an effort should be made to indicate candidly and forthrightly those instances where definitive results are not provided by analysis. At the same time it is important for the management analyst to set his study in the larger context appropriate for it. In preparing written reports, a suitable form might involve a simplified abstract version for the quick perusal of non-specialists, and a detailed report for specialists. Above all, it is important for management analysts and administrators to be prepared to participate in any follow-up or implementation activities, to assist with them and to evaluate their results.

In reviewing a study of an operating institution, it is the job of the management analyst to:

- Test the work against the general and specific guidelines already mentioned.
- Be rigorous but fair in his thought.
- Be candid about the basis for his statements.
- Be realistic about his demands in the light of the context and scope of the study being examined.
- Avoid personal attacks whether explicit or veiled.

In following up studies these same general and specific guidelines still hold. In this connection, it is perhaps useful for the analyst to recognize and report unpredicted results and unpleasant surprises that may emerge and stress the possible necessity of conducting further investigations.

The Leadership Function: The Use of Non-Analytical Methods

The Adversary Process

As you may already have learned long before now, decisions on the most vital and complex issues affecting the entire fabric of United States policy are most usually reached at the highest social, political and economic levels by means of a continuing adversary process. It has only been during the last few years that higher education generally and especially higher education among Negroes has risen to the center of national concern as a recognizable public issue. The increasing appreciation of the value of higher education with the entry of Negro colleges into the mainstream of higher education has brought both dangers and opportunities which are inextricably interwoven with the costs and benefits associated with the mechanisms of the generally accepted adversary process at work in American society. This adversary process is a recognized means for the pinpointing of conflict. The rules by which this adversary process operates differ substantially from those of a directed, logical system such as we usually associate with the arguments and analysis of scholarly research and discourse.

Yet this process forms the bedrock of vital decision making and political action in Western societies and cultures. The purpose of the adversary process is to enable persons or organizations with divergent viewpoints, attitudes, value systems, roles, objectives and vested interests to come to terms in the resolution of problems over which they stand in conflict. Since it is clear that not all complex problems can be solved by completely logical means, decisions in the real world quite often have to be reached on the basis of non-logical or non-rational methods.

Within the framework of the adversary process participants must attempt to influence decision making through the presentation of their cases. The purpose of these presentations is to indicate reasons why decisions should be made favorable to the participant or the interests which he represents. Two key assumptions on which this adversary process generally operates are that (1) the various viewpoints are adequately represented and (2) that the process of debate facilitates the education of decision makers. The process may include critiques of presentations by opposing sides.

Usually each participant's case appears quite complex. Some points in the case or position of one party may seem completely irrelevant to the values undergirding the position of the other party. Yet each party feels it necessary even if only as a matter of tactics at least to acknowledge and respond to the full range of arguments presented by the other.

As you may recall from viewing political debates and the course of other kinds of controversy on the national

action rather than another.

appraisal.

The Design of Data Collection Forms

Data Forms for Planning, Budgeting and Accounting

Some basic principles relating to the design of data forms for use in college and university business and development offices appear in the National Association of College and University Business Officers *Planning, Budgeting and Accounting Manual.*

Student Data Forms and Records

A statement of some basic principles concerning the design of student forms and models for the development of student records may be found in The National Association of College and University Business Officers *Student Records Manual.*

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2. College Management

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Frederick Betz, "On the Management of Inquiry" in *Management Science,* Vol. 18, No. 4, December 1971.

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3. College Operating Manuals

National Association of College and University Business Officers, *Planning, Budgeting and Accounting,* Section II of *A College Operating Manual,* Washington, D.C., National Association of College and University Business Officers, One Dupont Circle, 1970.

National Association of College and University Business Officers, *A Student Records Manual: Guidelines For the Administration of College Admissions, Financial Aid, and Registration Programs,* Washington, D.C., National Association of College and University Business Officers, One Dupont Circle, 1970.

COLLEGE ACCOUNTABILITY/GRADING/INFORMATION SYSTEM (CAGIS)

by

Optimum Computer Systems, Inc.

INTRODUCTION

PURPOSE

The purpose of this report is to present the overview of a Total Management Information System that has been developed for Mary Holmes College, West Point, Mississippi. The system described is intended to provide the college with a comprehensive and responsive information system. The system will provide coordinated listings of the major informational functions that must be maintained to assist the college management and faculty in the administration and academic functional areas.

Modular Approach

A comprehensive management information system which would be responsive and useful to Mary Holmes College is envisioned as containing several modules developed independently in building block fashion which will ultimately provide the college with an optimum, total management information system. The concept presented here attempts to use forms and informational sources already in operation as the base for feeding the system. Existing information reporting requirements, both internal and external, are also considered and incorporated into the system concept. The collection and assembling of individual data groups is addressed in a fashion which will group information in files, in the most accessible manner, for use in the separate subsystems. Many of the data files are interactive with more than one subsystem, so, it is imperative in the initial stages of system development that they be independent to allow for maximum flexibility in use. Further development of the system, once all of the individual subsystems are operational, will include consolidation and integration of some of the information files to concise master information data bases.

Subsystem Definition

The fact that any human oriented service requires many and varied lists and rosters of the serviced populus dictates a requirement for a responsive information system. In the case of the college this requirement includes both the students and the faculty/employee groups. Subsystems to provide information, rosters, schedules, grades, etc. to, from and about these groups are seen as having the highest priorities. OCS has devoted considerable attention to the two subsystems addressing these critical areas. The *Student Information Subsystem* incorporates a structure to provide Student Rosters, Schedules, Directories, Grade Cards and Grade Reports. The *Academic Management Subsystem* provides for the creation of Instructor Rosters, Faculty Allocation, Instructor Load and Assignments, Classroom Allocation and Utilization, Course Master Schedules, Student/Advisor Assignment and Evaluation and Analysis Reports. This subsystem structure is portrayed in Figure I-1, Overview of Total Management Information System.

Additional subsystems which will provide the required facility management, planning development and accounting back-up tools for supporting the academic function are:

- Fiscal and Accounting Subsystem

  Provisions are included in this subsystem for Payrolls, Personnel Reports, Student Loan Accounting and General Ledger production and accounting statements.

- Budget and Planning Subsystems

  This module includes Budget Preparations & Analysis, Facilities & Equipment Plans, Program Development and Curriculum/Program Planning provisions, Internal and External Funding Reports (available & required).

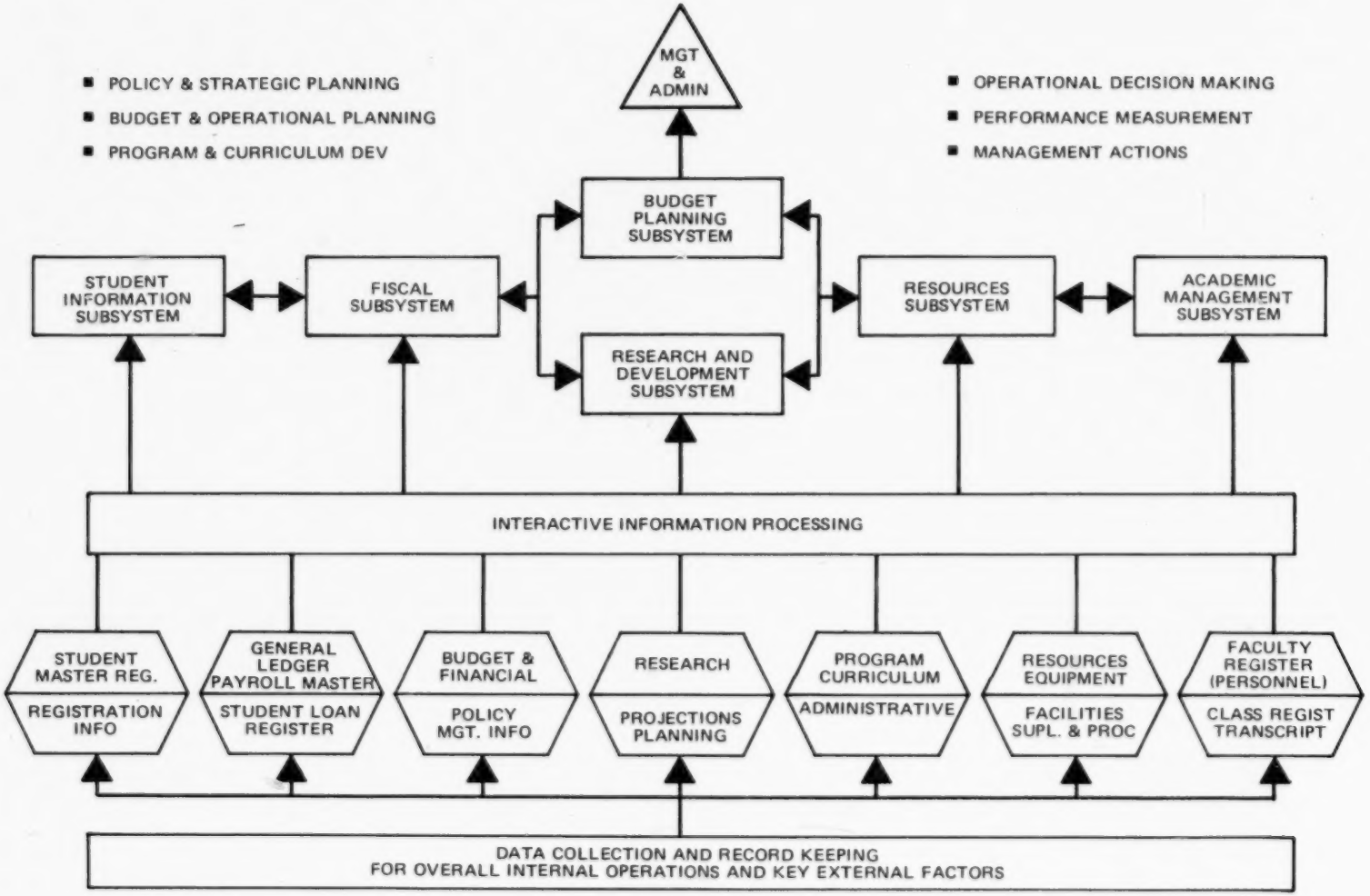


Figure I-1. Overview of Total Management Information System

- Resources Subsystem

  The Resources Subsystem provides for Inventory, Accountability, Allocation, Use and Planning information for the management of Physical Facilities, Equipment and Supporting Supplies.

- Research & Development Subsystem

  The Research & Development Subsystem, while not rigidly structured is seen as containing provisions for reports on Special Programs, Outreach and Update Development and Recruiting/Input Plans & Programs.

Each of the subsystems described is designed to function as a related management tool. Therefore, the development of specific support-oriented management tools will assure timely and economic control as well as maintain quality and meaningful output.

SYSTEM DESCRIPTION

INTRODUCTION

The comprehensive management information system which would be responsive and useful to the management of Mary Holmes College is envisioned as containing subsystem modules such as those described in this section. The recommended system consists of six subsystem modules that may be developed independently of each other. Each subsystem is discussed in overview fashion with system description, input, output sections and an overview interaction chart.

The final portion of the section describes the suggested file structure, including a preliminary listing of suggested data elements for those files that interact with the Student Information System.

STUDENT INFORMATION SUBSYSTEM

System Description

The Student Information Subsystem, the heart of both the system and college activities, is designed to process student related information. This overview description of this section is augmented by the more exhaustive procedural flow described in Section IV and the more detailed lists of input and output documents contained in Section III. This subsystem contains five modules, each related to a specific student accountability task, as indicated in Figure I-2.

Module I, the registration module, includes all activities related to preliminary registration processing the actual registration activities, and many of the post registration processes. Pre registration activities include accepting student applications, processing the applications and noting accepted/rejected applicants in the file structure. In addition all pre registration mailings and registration package composition activities are included in this task area. Registration processing consists of handling the registrants and completing student course assignments. Post registration activities include the many activities required to reconcile final course and class compositions, and to accept last minute add/drop requests.

Module II, the Student Roster Module, uses the final output file structures of Module I to prepare the required Student Rosters, with a wide variety of classifications, to serve the various college activity areas.

Module III, Student Schedules, is the module that prepares detailed schedules for student and office usage. These schedules record the registration activity and provide the student with his personal class schedule.

The Student Directory Module, Module IV, is designed to construct an extremely useful composite of student information by various government sequences of student data. In this manner, a multi-segmented publication will be useful to students, staff, and faculty.

Module V, the Grade Reporting Module, is structured for timely and accurate reporting of mid-term and final grades. Augmenting the actual grade reports are missing grade reports and graduating student reports. These additional reports improve error checking and graduation requirements determination processing.

Input

The following types of data are recommended as subsystem input:

- Registration Information
- Class Assignments
- Dormitory Assignments
- Instructor Assignments
- Student Loan Information
- Adjustments and Changes

Output

The following types of output reports are suggested:

- Student Rosters
- Registration Materials
- Student Schedules
- Student Directory
- Grades

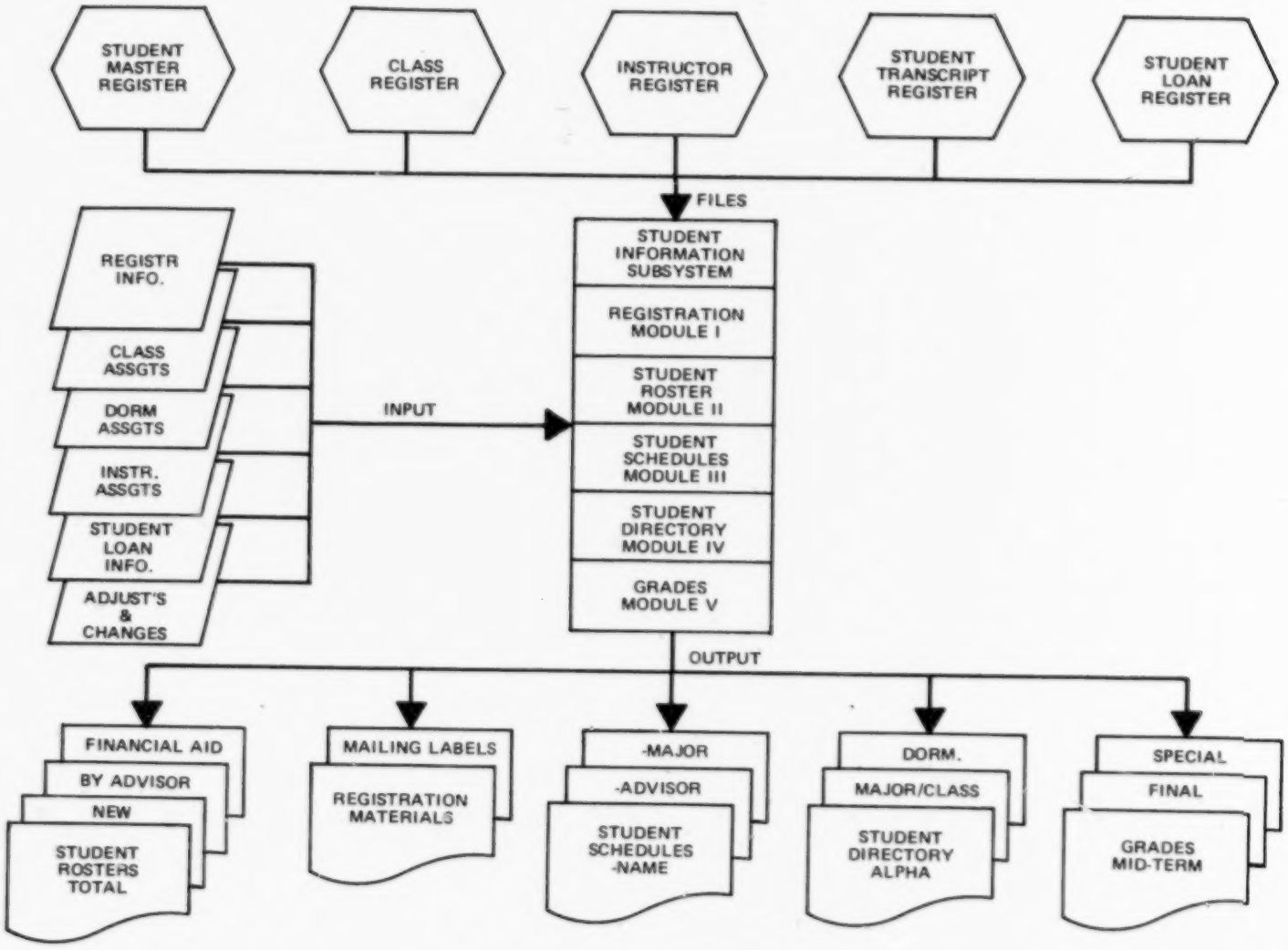


Figure I-2. Student Information Subsystem

Academic Management Subsystem

System Description

The academic management subsystem encompasses the requirement foreseen for managing the course/class/instructor assignments and utilization. A conceptual view of this subsystem, Figure I-3, indicates possible files, input and output of this subsystem. It is designed to include the information for comprehensive reporting of all elements of data needed to effectively coordinate, catalog and display faculty allocation-instructor load and assignments, classroom allocation and utilization, course status reports, course master schedules, student profiles by advisor and evaluation and analysis reports of course, classroom, instructor and advisor loads, utilization and availability. Other statistical and historical information reports could be structured as a part of this module if desired.

Input

Information needed as input to the processing functions for the academic management subsystem operation are:

- Instructor assignments
- Course/class schedule and load
- Student master data and assignments
- Classroom allocation and capacities
- Student/advisor assignments

Output

Listed below is a partial offering of the reports potentially useful for academic management:

- Instructor Rosters
- Faculty Allocation
- Instructor load and Assignment & Advisor Assignment
- Classroom Allocation and Utilization
- Evaluation and Analysis Reports

Fiscal & Accounting Subsystem

System Description

The Fiscal and Accounting Subsystem encompasses the management and disbursement of college funds as exhibited in Figure I-4. In order to efficiently discharge these duties a five module subsystem concept is proposed. Module I contains the payroll subsystem, the mechanism for storing data and writing payroll, federal, state and local checks and reports for the three distinct grouping on campus: faculty; staff; students. Module II contains provisions for establishing and maintaining a modern comprehensive personnel system. This module will provide periodic data and will be updated by hires and terminations. Module III processes data relative to Student Loan Accounting. This will consist of various updates of the Student Loan Register, the processing of payables, receivables and delinquent accounts. Module IV is the General Ledger processing required by any organization. This will include journal entries, posting to ledger accounts and acceptable trial balances. Module IV is closely linked to Module V, the preparation of routine accounting statements. These routine statements include the Balance Sheet, Source and Applications of Funds (Funds Flow), Income Statements, and various funds statements required by external agencies commensurate with grant funding.

Input

The general categories of input documents are as follows:

- Employee Transactions
- Payroll Transactions
- Student Loan Transactions
- General Accounting (Journal, Ledger) Transactions

Output

The output from this subsystem may be grouped into the following generic categories:

- Payroll
- Personnel
- Student Loan
- General Ledger
- Accounting Statements

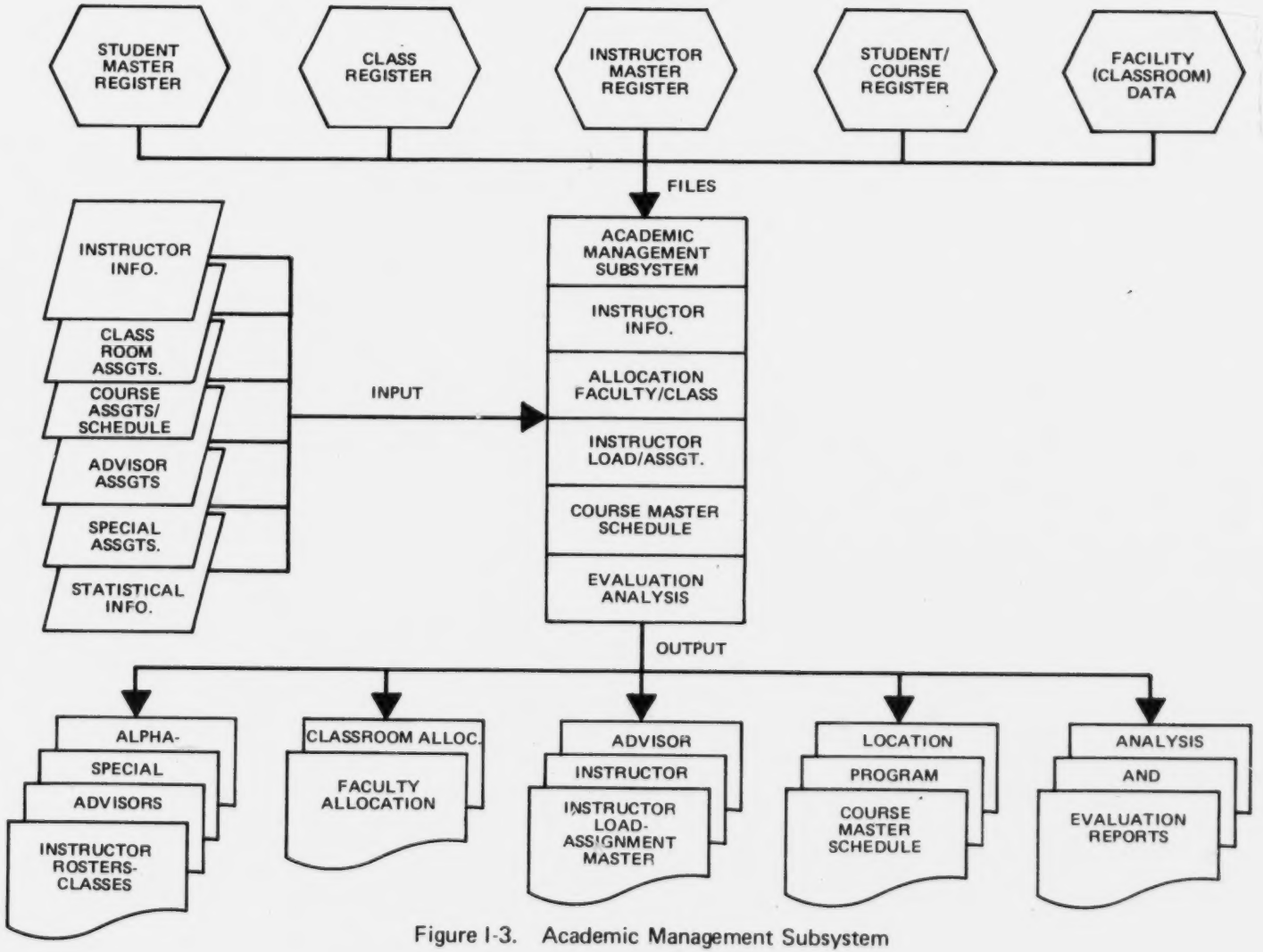


Figure I-3. Academic Management Subsystem

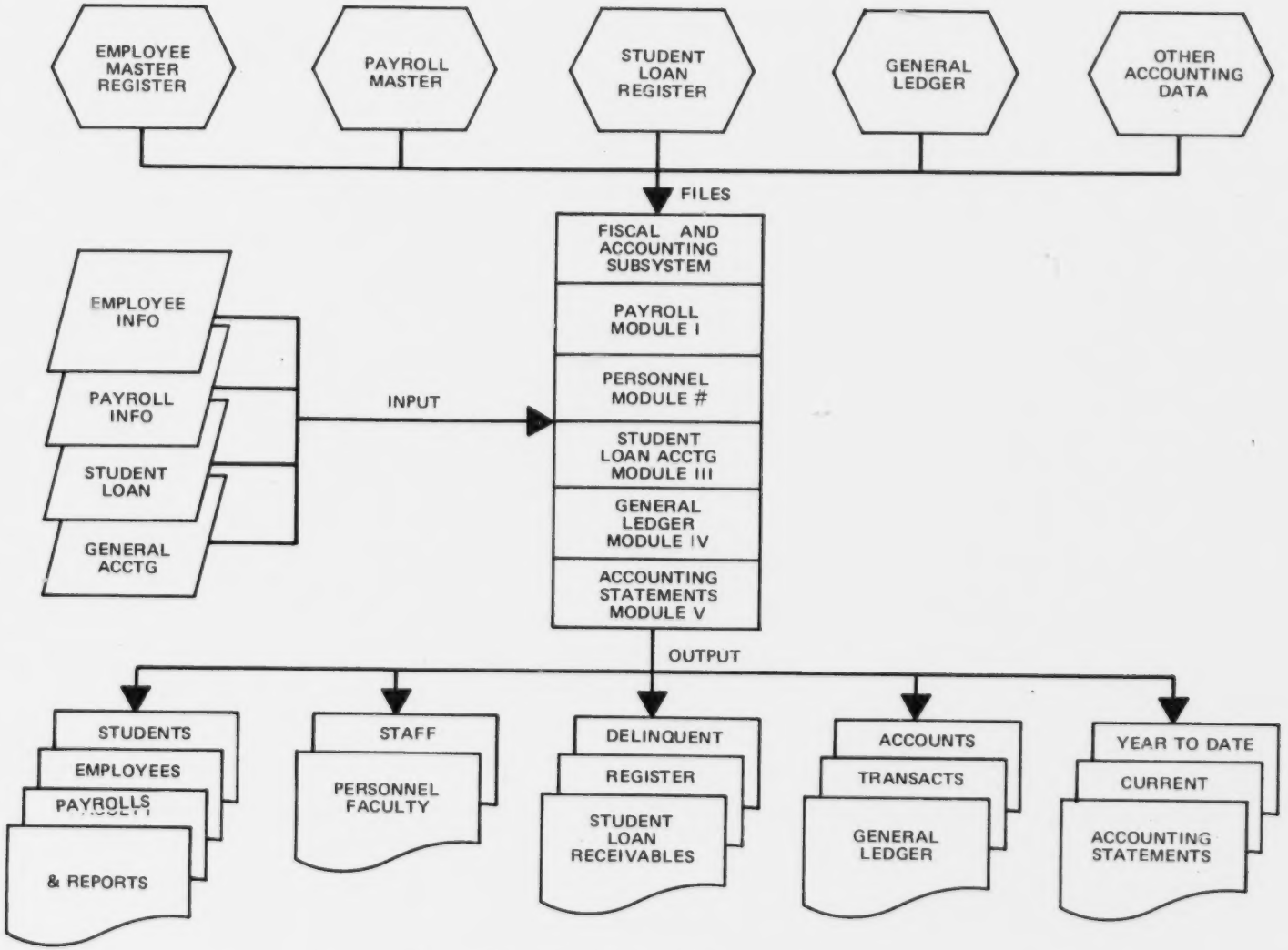


Figure I-4. Fiscal & Accounting Subsystem

Budget and Planning Subsystem

System Description

The Budget and Planning Subsystem is the central college mechanism for providing forward looking (forecasting) information to the management decision areas. The five modules that are suggested for optimum performance of this subsystem are displayed in Figure I-5, along with supporting elements. The budget module will construct budget planning figures with respect to the academic, research and operating posture of the college based upon future student, staff, faculty and plant composition. The second module, Funding Analysis will project the funds flow based upon projected funds sources and application of funds to the Module I products. This will incorporate both internal and external funding considerations. Module III, Curriculum Plans, will provide trends and projections of the total college, specific departmental areas and course loading based upon probable student composition. This will enable college management to make intelligent decisions based upon projected data.

Module IV Program Development, will provide insight towards desirable improvements in the respective programmatic areas. As curriculum trends are forecast, programmatic changes will be desirable, the enlargement of various departments will become obvious by virtue of vastly expanded demand for courses and increased program loading. New courses and departments will be suggested as logical compliments to heavily populated existing course/department loading, and so forth. Module IV provides the logical conclusion to the planning process, the forecasting of future facilities and equipment requirements. It will be readily obvious from trend increases in other modules where student loadings will outstrip current facilities, in terms of classroom, dormitories, laboratory equipments and other support units.

This subsystem is the one important unit that will maintain a viable and forward looking management policy, commensurate with a progressive institution of higher learning.

Input

Suggested types of input to the Budget and Planning Subsystem are listed below:

- New Budgetary Figures and Changes
- Funding Data
- Curriculum Changes
- Program Changes
- Facilities and Equipment Estimates

Output

The following groupings of subsystem outputs are suggested:

- Budgetary Planning Outputs
- Funding Analysis Outputs
- Curriculum Plans
- Program Development Plans
- Facilities and Equipment Plans

Resources Subsystem

System Description

The Resources Subsystem is designed to process requirements information, as inputs, and generate resource descriptive outputs. Figure I-6 displays the essential elements of this subsystem. Personnel, course, facilities, equipment, purchase, inventory, repair and maintenance requirements and information are processed in order to provide allocation reports, procurement reports, inventory reports, repair and maintenance events (schedule/completion) and requirements planning reports. The facilities/equipment module, the first of five suggested modules, will provide information on facilities and equipment to determine the usefulness and allocation of existing resources. The procurement module, linked with the Fiscal and Accounting Subsystem will provide procurement schedule information. The inventory module will maintain and update the college inventory of resources such as equipment and supplies. Some economic order quantity processing may be included in high turnover items. The repair and maintenance module will provide the capability of generating pre-set maintenance lists as well as maintaining a log that will display areas of high and/or increasing maintenance activity. This will allow college management to isolate problem areas before breakdowns or shortages occur. The Requirements Planning Module will coordinate input requirements from all areas of college management and produce the planning requirements configuration reports which indicate the planning requirements posture of the college.

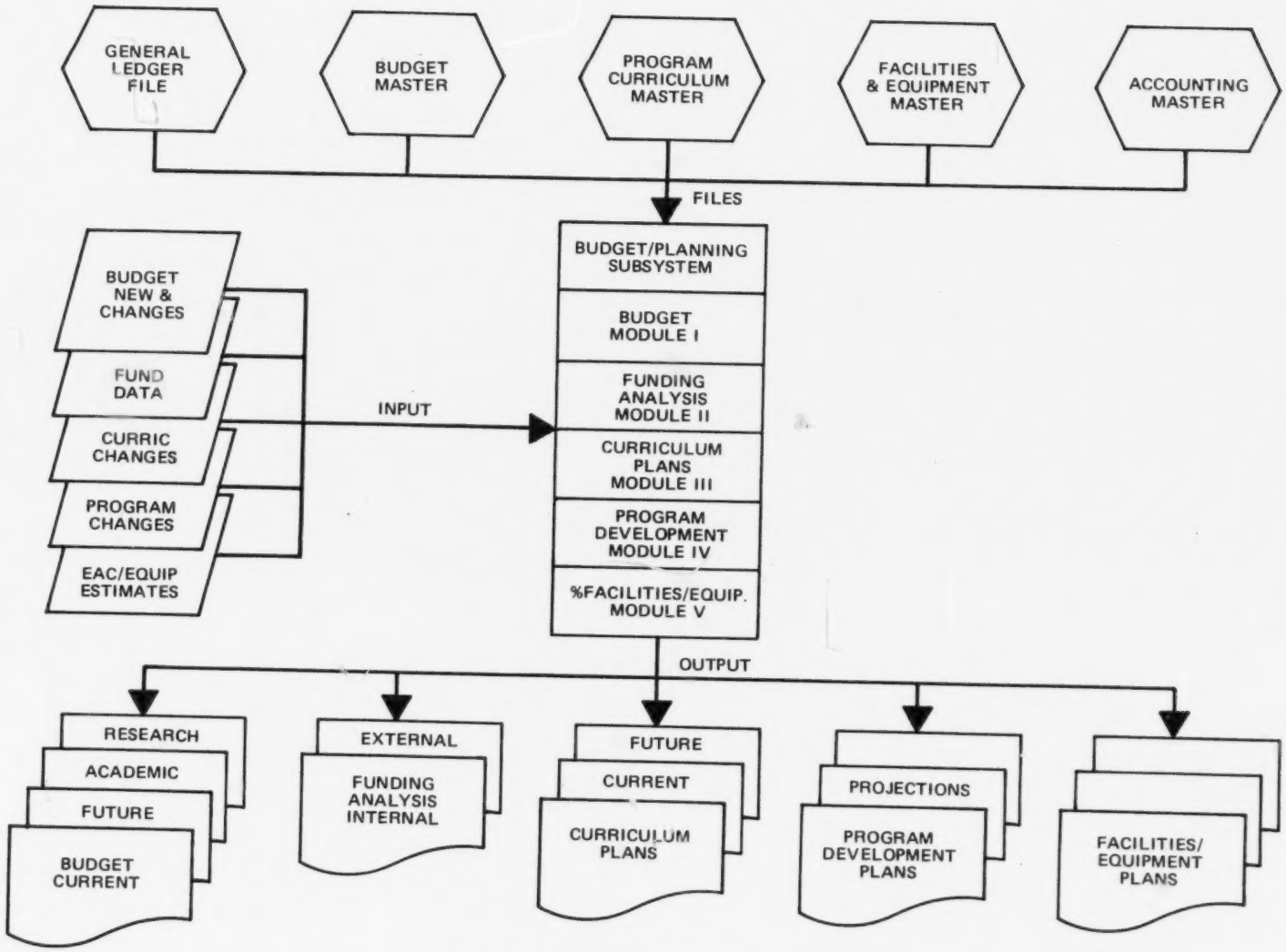


Figure I-5. Budget/Planning Subsystem

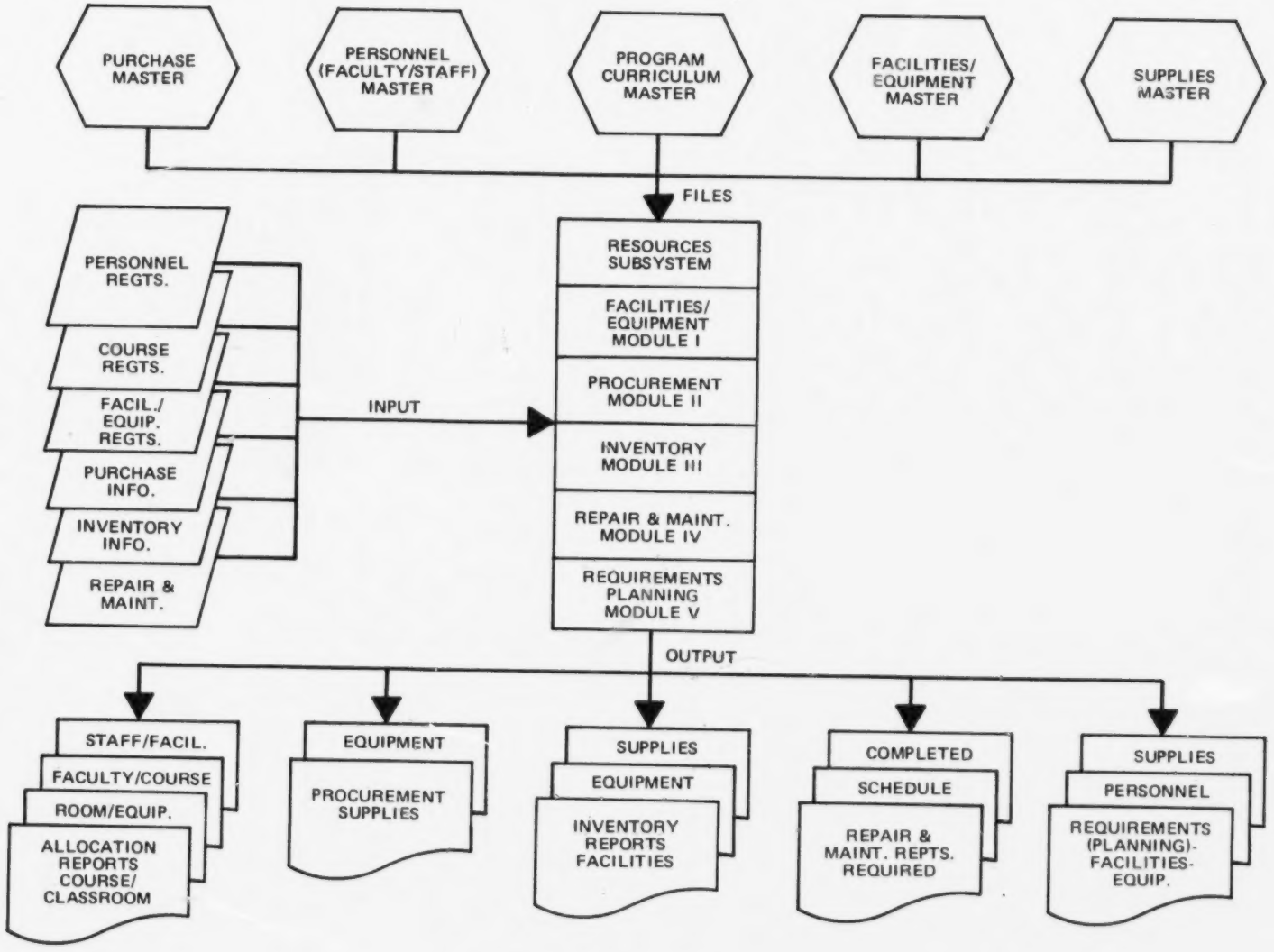


Figure I-6. Resources Subsystems

Input

The following items are deemed desirable inputs to the subsystem:

- Personnel Requirements
- Course Requirements
- Facility and Equipment Requirements
- Purchase Information
- Inventory Information
- Repair and Maintenance Information

Output

The following list indicates major report classifications:

- Allocation Reports
- Procurement Reports
- Inventory Reports
- Repair and Maintenance
- Requirements Planning

Research and Development Subsystem

System Description

The Research and Development Subsystem is designed to implement and monitor Research and Development Activities sponsored by the college. In addition to programmed research, the subsystem will also monitor outreach type programs and college recruiting activities. An overview, subsystem chart is displayed in Figure I-7.

Input

Suggested inputs to this subsystem will include:

- Special Program Information
- Government (Fed/State/Local) Information
- New Student and Recruitment Information

Output

Subsystem outputs will consist of the following report classifications:

- Special Programs Reports
- Development Reports
- Recruiting Reports

File Structure

The preceding paragraphs have briefly described how the various subsystems will operate, including basic types of input and output data. This section will deal exclusively with the data files, the supporting storage areas where information for the Total Management Information System is contained. The section is divided into two parts. First a description of the files affecting the Student Information Subsystem will be discussed. Then all other files in the system will be listed, and a matrix showing the applicability of files to the various subsystems will be cited.

Student Information Subsystem Files

The Student Information Subsystem will interact with five of the Total Management Information System files. These five files have been detailed to some extent in Figures I-8, I-9, I-10, I-11, and I-12. The format of these figures is to portray suggested data elements that would be file resident.

Other Subsystem Files

The Student Information Subsystem will contain most of the system activity. However, this activity is centered around relatively few files. The other five subsystems will utilize varying types of information which will be contained in the following files:

- Budget Master
- General Ledger
- Accounting Data Master
- Payroll Master
- Recruiting Plans

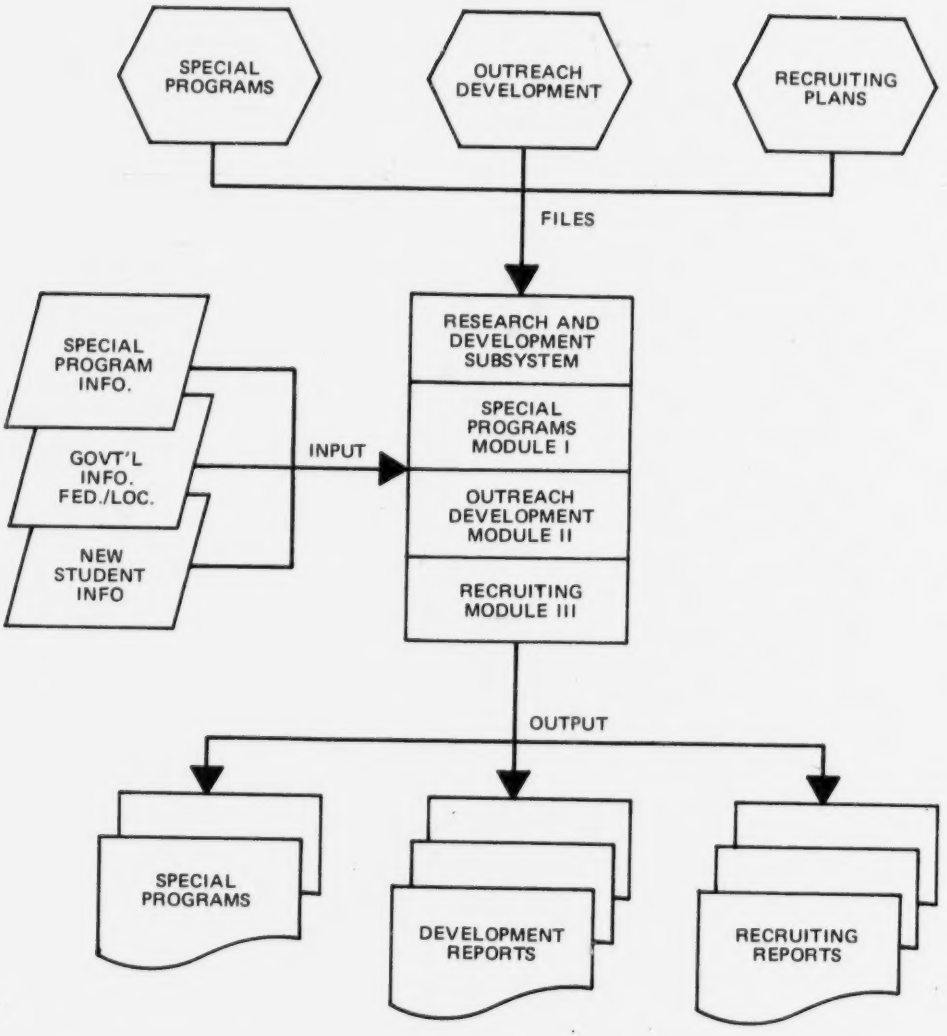


Figure I-7. Research and Development Subsystem

- Special Programs
- Purchase Master
- Supplies Master
- Facilities/Equipment Master
- Employee Master Register (Personnel Master)
- Program/Curriculum Master
- Facility (Classroom) Data
- Student Course Register

In order to develop the relationship of how files will be utilized Figure I-13 has been developed. This Total System File Matrix displays the various subsystems on one axis and the file designations on the other axis. The matrix elements then indicate the usage of files within subsystem processing activities.

FILE DESCRIPTION

Name: Student Master Register (Suggested List of Data Elements)

- Name
- Social Security Number
- Address
  - Street & Number
  - City/County
  - State
  - Zip
- Phone
- Sex
- Birth Date
- New Student Code
- Advisor
- Financial Aid Code
- Major
- Dormitory Number
- Resident/Commuter Status
- Cummulative GPA
- Current Quarter GPA
- Data Accepted
- Emergency Notification—Name, Phone, Address
- Test Score Data
- Status Code
  - Class Status (Applicant thru Graduate)
  - Student Disposition
  - Full Time/Part Time
  - Special Programs—Co-op, teaching
- Military/Selective Service Status

Figure I-8. Student Master File Description

FILE DESCRIPTION

Name: Student Loan Ledger (Suggested Data Elements)

Student Name

Social Security Number

Loan Information—Amount, Balance, Interest, Payable dates, etc.

Loan Classification

Loan Source

Figure I-9. Student Loan Ledger File Description

FILE DESCRIPTION

Name: Class Register (Suggested Data Elements)

Header Record

- Class Name
- Section Name
- Class Number
- Instructor
- Building & Room
- Credit/Non Credit
- Quarter Hours
- Period
- Day Code

Detail Record

- Student Name
- Class Status
- Social Security Number
- Section Number
- Class Number
- Major
- Grades—mid-term, final, other

Figure I-10. Class Register File Description

FILE DESCRIPTION

Name: Student Transcript Register (Suggested List of Data Elements)

Name

Social Security Number

Graduation Date (when applicable)

Major

First year

First Quarter
Course Name, Desc, Number, Grade (up to 10 courses)

Second Quarter
Course Name, Desc, Number, Grade

Third Quarter
Course Name, Desc, Number, Grade

Summer Session A
Course Name, Desc, Number, Grade

Summer Session B
Course Name, Desc, Number, Grade

Second Year

First Quarter
Course Name, Desc, Number, Grade

Second Quarter
Course Name, Desc, Number, Grade

Third Quarter
Course Name, Desc, Number, Grade

Summer Session A
Course Name, Desc, Number, Grade

Summer Session B
Course Name, Desc, Number, Grade

Figure I-11. Student Transcript Register File Description

FILE DESCRIPTION

Name: Instructor Register (Suggested Data Elements)

Instructor Name

Degrees

Academic Division

Address Data

Social Security Number

Current Class Assignments

Figure I-12. Instructor Register File Description

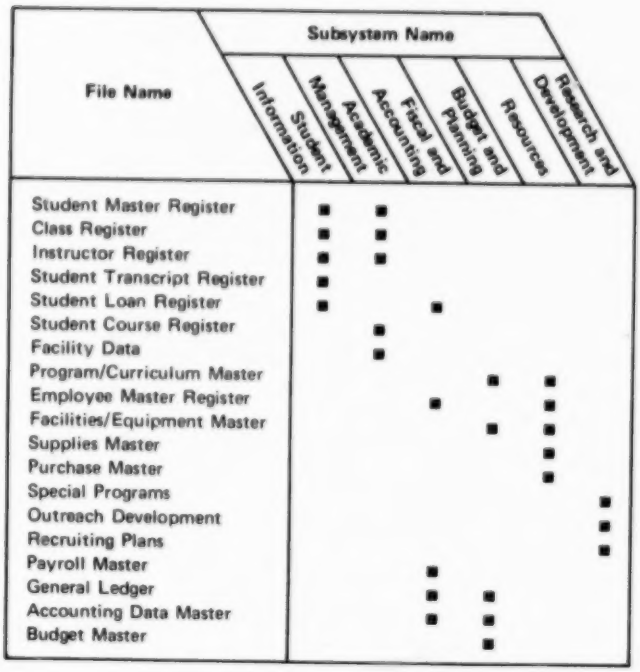


Figure I-13. Total System File Matrix

FORMS DESIGN

GENERAL

The forms design section is essentially divided into two areas—input and output. This section will first discuss the definition and scope of input, then provide a discussion of input forms that may be used in the Student Information Subsystem. Next the definition and scope of output will be considered, followed by a discussion of output reports that may be used in the Student Information Subsystem.

A general discussion area has been selected to provide examples of both input and output forms. The Student Information Subsystem is considered to be the most appropriate area for this discussion since it is the most significant of the six subsystems in terms of informational assistance, and because it will contain and provide data that will have the immediate benefits of an analysis of the student body and the educational structure of the college.

Input

The input area first provides a definition and scope section, then it provides a section that discusses actual input forms that may be used in conjunction with the Student Information Subsystem. The major intent of this section is to relate suggested subsystem input requirements to input gathering devices already in existence at Mary Holmes College. These input requirements are intended to provide data that will update the various suggested data elements as contained in the File Descriptions. These data elements are then aggregated and sorted to produce the various outputs of the subsystem.

Definition and Scope

Input consists of documents of all sizes and types that contain information essential for the maintenance and update of the system/subsystem files. Examples of the wide range of inputs include: Travel Expense Report, Student Application Forms, Quarterly Registration Forms, Notice of Absence Form, Student Enrollment, Notice of Withdrawal, Academic Probation List, Dean's List, Office of Financial Aids Reports.

The processing system can produce reports only when the required informational elements for the reports are made available (i.e., input) to the system information files. In a comprehensive Management Information System almost all data gathered within the range of the system (i.e., within all the operating functions of the college) serve as input into some subsystem of the total Management Information System.

The physical attractiveness and apparent importance of the actual input forms involved affect the total system only in terms of the accuracy and timeliness of the data elements themselves. Therefore, highly computerized systems are prone to the development and usage of specially formatted input documents for ease of data entry and accuracy of content. It should be stressed that almost all necessary input for a Total Management Information system is now being collected, in some manner, by Mary Holmes College. The problem, therefore is not the ability to collect the data, but rather the ability to input the collected data into structured system files.

Appendix A

INTERNAL REPORT DISTRIBUTION

REPORT DESCRIPTION	Frequency	Due Date	PRES: President	RESEARCH AND DEVELOPMENT: Research & Evaluation	Director 13—College Curriculum	Black Arts Theater	Director Oral History Project	ACADEMIC AFFAIRS: Additional Project	Additional Project	Deans	Department Heads	RESOURCES MANAGEMENT: Vice President	Service	Chief Accountant	Bookstore	Business Office	Physical Plant	Director of Personnel	Planning & Development	Purchasing	Computer Center	Supervisor of Maintenance	Director of Food Service	STUDENT AF: Librarian	Health Center	Publicit
Student Roster—Total Student Body	Q	Beg.		■	■							■	■		■											
Student Roster—New Students	Q	Beg.			■							■	■													
Student Roster—By Advisor	Q	Beg.		■	■							■	■													
Student Roster—By Financial Aid Received	Q	Beg.		■	■							■				■		■								
Student Schedule—By Student Names	Q	Beg.										■	■													
also critical error analysis	Q											■														
Student Schedule—By Major	Q	Beg.			■							■	■													
Student Roster Profile—By Advisor	Q	Beg.		■	■							■	■													
Student Directory	Q	Beg.		■	■			■		■		■	■		■	■		■		■		■		■			
Geographic Distribution—All Students	Q	Beg.						■				■	■	■												
Geographic Distribution—New Students	Q	Beg.						■				■	■	■												
Class Listings	Q	Beg.										■	■	■												
Student Reports and Grades—																										
Mid Term Grade Reports	Q	M.T.										■	■	■												
Final Grade Report	Q	End										■	■	■												
Student Grade Transcript	Q	Req.										■	■													
Course Master Schedule	Q	Beg.		■								■	■	■	■					■						
Classroom Utilization Report	Q	Beg.			■							■	■	■				■								
Student Class Analysis Report	Q	B/MT			■							■		■												
Aggregate Hours Report	Q	B/MT			■							■		■												
Grade Distribution—By Instructor	Q	MT/E			■							■	■	■												
Grade Distribution—By Class	Q	MT/E			■							■	■	■												
Enrollment File Update	Q	Beg.										■														
Update Verification Report	Q	Wk																								
Students Registered but not on File	Q	MT/E																								
Missing Grade Report	Q	MT/E										■	■	■												
Course Status Report	Q	Beg.		■								■	■													
Applicant File—By Application	Q	MT/E										■			■						■					
Quarterly Grades Financial Aid Students	Q	End		■																						
Mid-Term Grades Financial Aid Students	Q	MT		■																						
Summary Grade Report by Department	Q	MT/E		■								■	■													
Instructor Load and Assignment	Q	B/MT		■	■							■	■		■					■						
Student Receivables (Accounts)																										
A. Register	Q	5th													■	■										
B. Billing	Q	5th													■	■										
Student Loan Receivables																										
A. Register	M	5th													■	■										
B. Billing	M	5th													■	■										
C. Delinquent Status	M	5th													■	■										
D. Changes in Fund Balance	M	5th													■	■										
Payroll—Student Personnel																										
A. Daily Attendance Report	D	D													■	■				■						
B. Time Sheets	W	W													■	■				■						
C. Payroll Register	W	W													■	■										
D. Deduction Register	W	W													■	■										

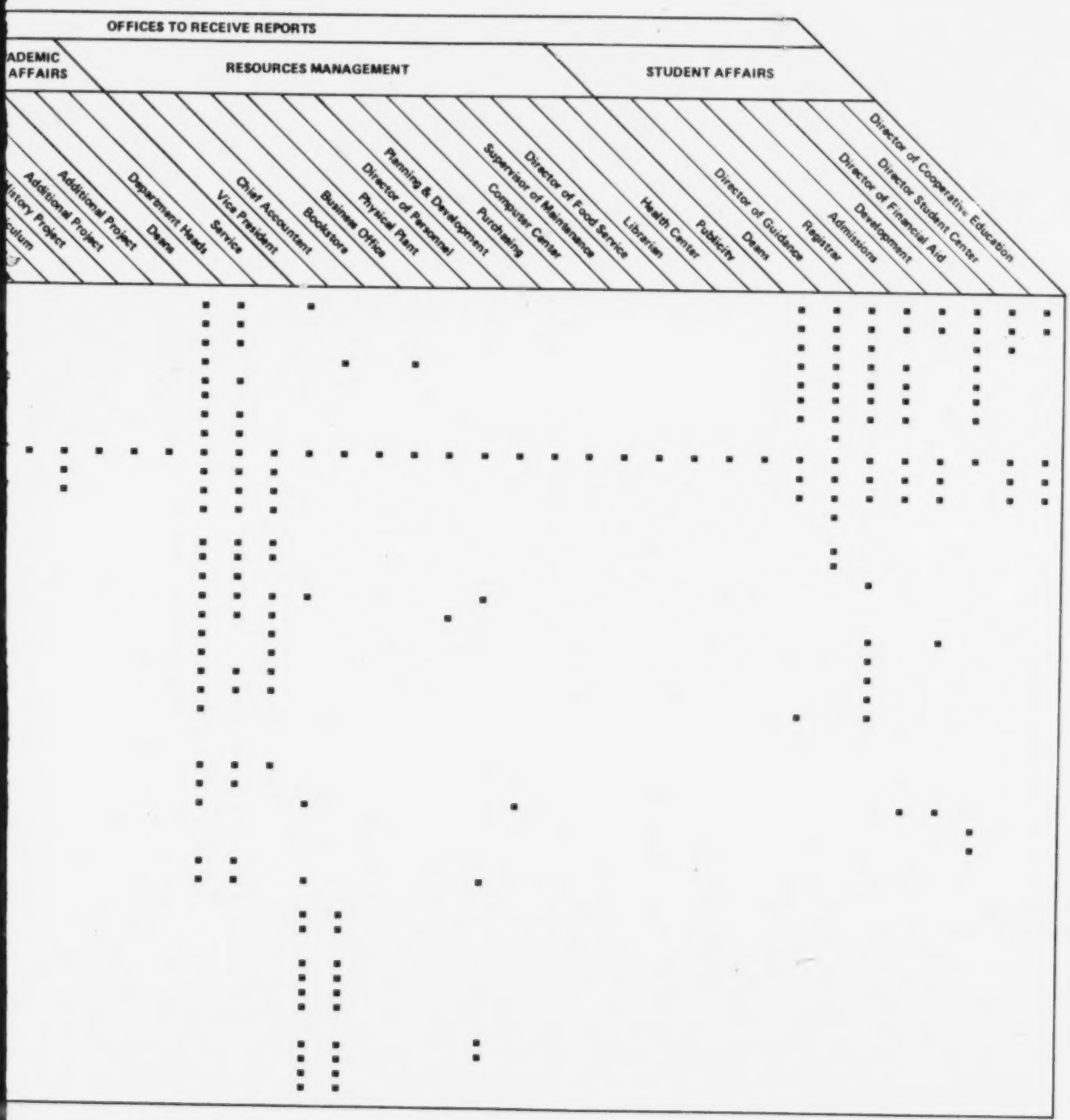
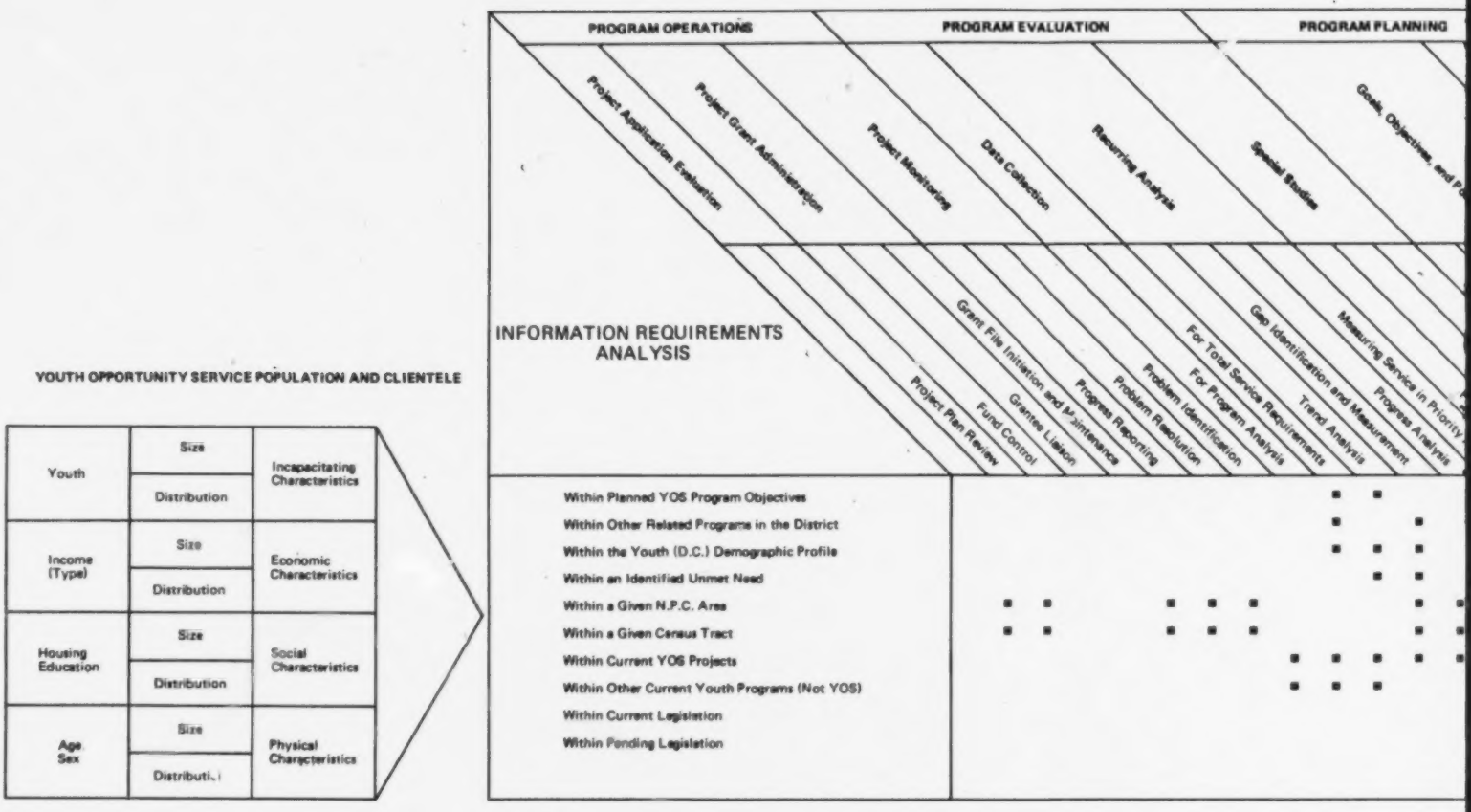

OFFICES TO RECEIVE REPORTS
ADEMIC AFFAIRS
RESOURCES MANAGEMENT
STUDENT AFFAIRS
Additional Project
Additional Project
Deans
Department Heads
Service
Vice President
Chief Accountant
Bookstore
Business Office
Physical Plant
Director of Personnel
Planning & Development
Purchasing
Computer Center
Supervisor of Maintenance
Director of Food Service
Librarian
Health Center
Publicity
Deans
Director of Guidance
Registrar
Admissions
Development
Director of Financial Aid
Director Student Center
Director of Cooperative Education

Figure I-14.



YOUTH OPPORTUNITY SERVICE POPULATION AND CLIENTELE

Youth	Size	Incapacitating Characteristics
	Distribution	
Income (Type)	Size	Economic Characteristics
	Distribution	
Housing Education	Size	Social Characteristics
	Distribution	
Age Sex	Size	Physical Characteristics
	Distributi.i	

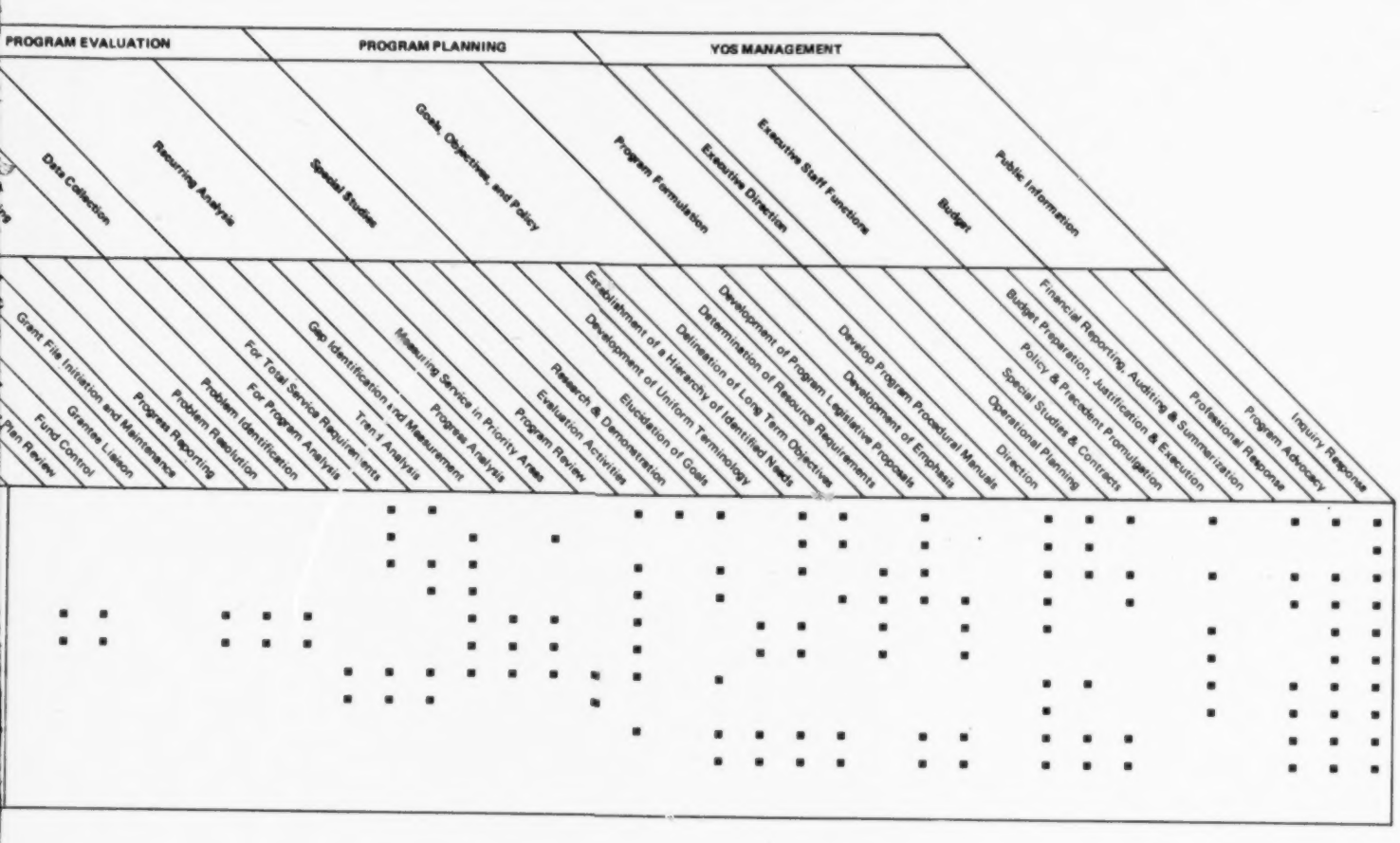

PROGRAM EVALUATION
PROGRAM PLANNING
YOS MANAGEMENT
Data Collection
Recurring Analysis
Special Studies
Goals, Objectives, and Policy
Program Formulation
Executive Direction
Executive Staff Functions
Budget
Public Information
Grant File Initiation and Maintenance
Grantee Liaison
Fund Control
Plan Review
Progress Reporting
Problem Resolution
Problem Identification
For Program Analysis
For Total Service Requirements
Gap Identification and Measurement
Trend Analysis
Measuring Service in Priority Areas
Progress Analysis
Program Review
Evaluation Activities
Research & Demonstration
Development of Uniform Terminology
Elucidation of Goals
Establishment of a Hierarchy of Identified Needs
Delineation of Long Term Objectives
Determination of Resource Requirements
Development of Program Legislative Proposals
Development of Emphasis
Develop Program Procedural Manuals
Direction
Operational Planning
Special Studies & Contracts
Policy & Precedent Promulgation
Budget Preparation, Justification & Execution
Financial Reporting, Auditing & Summerization
Professional Response
Program Advocacy
Inquiry Response

Figure I-15.

Appendix B

EXTERNAL REPORT DISTRIBUTION

EXTERNAL REPORTING SYSTEM
MARY HOLMES COLLEGE

NAME AND NUMBER OF REPORT	INTERNAL REVIEW DATE: Originate In Office By	Due in Division Head	Due in Pres. Office	EXTERNAL AGENCIES: External Due Date	Board of National Missions	HEW Higher Education	State Commission	State Accred.	Southern Assoc.	State Bldg. Comm.	NSF	HEW	DOL	OEO	TACTICS	NIH	SACS	Foundations	Selective Service	Examining Board	Employers
FINANCIAL																					
Monthly Activities Report	31	5	10			■	■	■					■			■	■				
College Work Study Report													■			■	■				
Economic Opportunity Grant Report																■	■				
National Defense Student Loan													■			■	■				
Title III Report													■			■	■				
Cooperative Education							■						■			■	■				
SACS					Ann.														■		
National Science Foundation Report					Qtly.						■										
General Ledger					Qtly.	■															
Budget Expenditure Summary	31		10		Qtly.	■	■	■					■								
Requisitions:																					
(1) Financial Aid						■	■						■								
(2) Title III							■						■								
Library Report–Title II							■						■								
Funding Agency Reports						■	■	■			■		■	■	■	■	■		■		
Departmental Expense Reports					Qtly.	■	■				■		■	■	■	■	■		■		
EXTENSION PROGRAMS																					
(1) Monthly Activities Report	31	5	10																		
(2)																					
(3)																					
(4)																					
(5)																					
(6)																					
ACADEMIC AFFAIRS																					
Monthly Activities Report	31	5	10																		
HEGIS Report					Ann.		■														
Accreditation Report						■			■	■	■					■			■	■	
Program Planning Report						■	■	■		■		■	■			■			■		■
Quarterly Activities Report						■	■			■						■					
Student Disposition Report						■	■	■		■			■	■	■	■	■		■		
RESEARCH AND DEVELOPMENT																					
Foundation & Federal Aid Report	31	5	10			■	■	■			■		■	■	■	■	■		■		
Budget Status Report																					
Project Status Reports													■	■	■		■		■		
Annual Report						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Public Information						■	■			■						■		■	■		■
President's Report						■	■	■		■		■				■		■	■		■
Selective Service Student–Certificate																		■		■	
College Financial Status Report						■	■	■											■		■

Figure I-16.

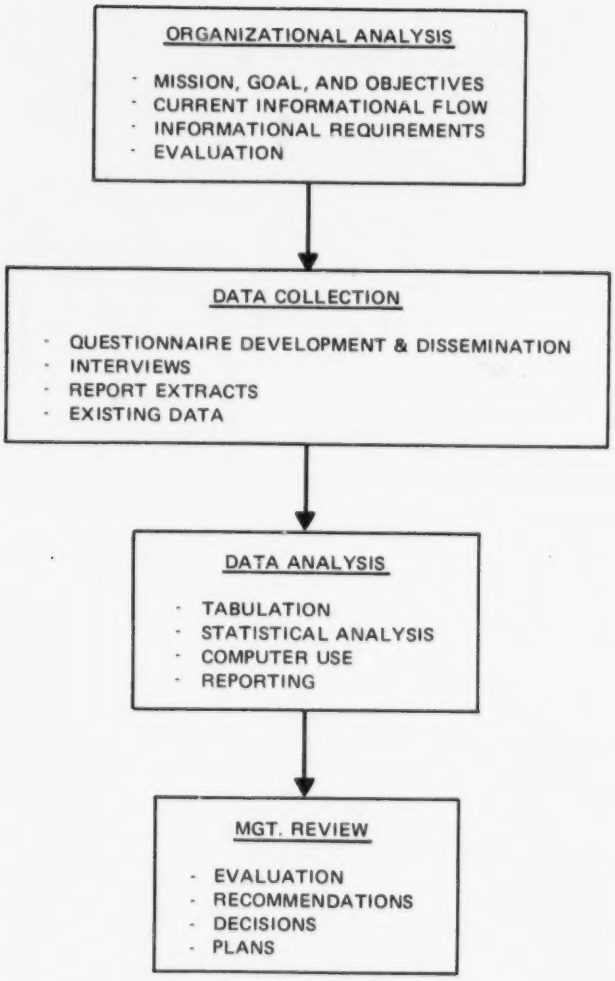


Figure I-17. Systems Analysis Overview

Section II
DATA MANIPULATION

Abstract

The Data Manipulation session had as its primary components—a lecture on statistical indicators, a demonstration of the terminals and how they may be used for statistical analysis and visual display, a data preparation workshop and a data analysis workshop, each workshop utilizing a workbook to give the participants experience in applying the theories set forth in the text of the lecture materials.

The primary materials used during this session were (1) "A Brief Discussion of Statistical Indicators"[3]; and (2) "Data Preparation and Analysis Workbook"[4], used for the Data Preparation and Data Analysis Workshops.

In the first workshop, the workbook was used to give the participants an understanding of the procedures for organizing raw data so that it could be used to perform statistical analyses. From the exercises, the participants could produce a series of data analysis forms in a manner that allows for statistical calculations.

The second workshop provided the participant with experience in obtaining the various statistical indicators described during the previous session (e.g., frequency distributions, trends, projections) and also a briefing on the use of computer terminals for making more sophisticated calculations utilizing larger volumes of data (e.g., norms, standard deviations and correlations). Other kinds of statistical indicators could have been mentioned (e.g., chi-square), but were eliminated because of time limitations. However, references or bibliographies were given to those participants wanting to pursue the topic further and apply other available statistical indicators.

"A Brief Introduction to Statistical Indicators for College Administrators" has as its main purpose "to examine the potential and limitations of statistical methods and to develop, from a practical point of view, three particular statistical indicators." The text follows.

A BRIEF DISCUSSION OF STATISTICAL INDICATORS

by

Charles Chambers
Clinton E. Jones
Lawrence Lezotte

INTRODUCTION

During this session of the institute, we shall be concerned primarily with developing an understanding of some basic statistical concepts and methods. Actually, we will simply review a few statistical concepts with which you are already familiar. Therefore, it is not our purpose to go into an abstract or theoretical development of statistical analysis. I believe most of us would agree that it is easier for one to arrive at a sound interpretation of data and make meaningful decisions, when one understands the basic properties of statistical indicators. It is possible not only to choose the proper model for each situation, but also to be able to defend its use in making competent management decisions.

Before one begins to analyze a collection of data for decision purposes, certain subjective factors should be considered. These include such factors as homogenity or uniformity of data and the relevancy of the statistics. Each set or subset of data should have sufficient points for the statistics to have true meaning, while at the same time an acceptable degree of uniformity should exist within each distribution.

As an example, consider a distribution comprising personnel salaries in your institution. This set would include several levels of professors, staff, and top administrators. Statistical indications about this data could lead to false conclusions. More confident and relevant interpretations might be made by considering the subset of professors or assistant professors in a given department. Therefore, as we view our data for uniformity by partitioning into categories or subsets, we must determine whether our subsets have sufficient points so that we can trust our statistics.

To properly interpret statistical measures derived from data, it is important for one to know if the data being studied comprises all of the raw data of a given population or whether the distribution is only a sample of the population of interest. From this, one determines whether the descriptive statistical approach or the sampling statistical approach is relevant to the distribution. I'm sure that most of us know that the descriptive statistical approach makes use of all the data concerning a population, and entails deriving descriptive statistical measures from the data. Of course the word "population" does not imply vastness. For instance, the salaries of the assistant professors in the Political Science department of your school might constitute a population of interest to us. Suppose there are 20 in this set. The average salary is a descriptive statement about the population, and we are content to say that our interpretation of the average is a meaningful statement about the group itself. Note if $11,000 is the average salary of this population, and if $11,500 is the highest salary paid assistant professors in your school, then we might say this average indicates that these professors are receiving good salaries relative to the school's maximum for this academic rank. Because our concern in this case did not extent beyond the group we measured, we have used descriptive statistics.

The approach of sampling statistics becomes relevant when we have access to only a sample drawn from the population of interest and we do not have in our possession the raw scores comprising the total population. We might have the same data for the 20 assistant professors, but we might wish to enlarge our population of interest to include all assistant professors in the given school. Now, the salaries of the 20 persons comprise a sample drawn from a larger population that remains unseen, but yielded the sample. Therefore, under this condition an average of $11,000 might lead us to conclude that the salaries in this school *tend* to be good. If our distribution had been a random or stratified random sample drawn from the population of interest, our computed average would then be more meaningful. (Define random and stratified random samples if needed.)

A word now about abuses of statistics and skepticism that have resulted.

Many abuses of statistics have appeared in popular publications by management, labor, government and education. Often these abuses are the results of ignorance rather than design. As we shall soon discuss, there is quite a difference among the mean, median, and mode, though

all three are apt to be described as averages. Management and labor have clashed because averages have been sited that were computed correctly, but interpreted so as to be most advantageous to each vested interest.

The man on the street can scarcely get through a day without being involved in some kind of survey, or having statistics cited to him through some form of the news or communications media. Although distortions are in fact often carried out with the aid of statistics, the fault is that of the individual using inappropriate methods and it makes no sense to blame the statistical orientation itself. Briefly, I will mention three main objectives that have been verbalized against uses of statistics; (1) that statistics are untrustworthy since by using statistics one can prove anything, (2) that statistical thinking is unfair because it is anti-individual, and (3) that the use of statistics in connection with human social problems is cold and without feeling.

Administrators are called upon to make projections and estimates on enrollments, revenues, and facilities for five and ten year periods. Can we collect and organize sets of data from which we generate and interpret statistics that can be trusted for making honorable and sound decisions by top administrators?

To this end we shall examine three very basic statistical indicators which can enable us to give much breadth, precision and clarity to describing basic characteristics of our schools. These indicators are the mean, standard deviation and correlation. They are often fingerprints of our data, yet in themselves, they say nothing; but as clues for detecting what is happening they can help us make judgments to interpret relations and search for causes.

The Mean Value

The most common statistical concepts to indicate the middle or location of the central value of a distribution are the MEAN, the MEDIAN, and the MODE. The best way to convey the meaning of each is by simple illustration.

Consider a set of five observations—five employees with salaries as follows:

employee #1	$ 4,000
employee #2	4,000
employee #3	5,000
employee #4	7,000
employee #5	10,000

Def. 1 The Mode is the value of the term that appears most frequently. This is $4,000.

Def. 2 The Median is the value of the term that is larger than or equal to or smaller than half of them. The median is $5,000.

Def. 3 The Mean is the value that is obtained by adding the terms and dividing their sum by the number of terms. This is $30,000/5 = $6,000.

It should be noted that the mean is not actually a term of the distribution and should be thought of as a statement about the distribution itself. Also if we increase the $7,000 salary to $17,000, the next Mean becomes $8,000, yet the Median and Mode have not changed. Some changes in data will affect all three measures. The Mean however, responds to every change and is described as "sensitive" and as reflecting the entire distribution. Its sensitivity may be seen as a hint to its importance, yet it may be a disadvantage to its representativeness when the distribution contains a few outlying terms at one extreme. We may say the Mean is more efficient than the Median in the sense that all of the numerical values of the observations are used in its computation and also that the Means of a larger number of samples from a population will in general be less variable than the Medians of the same samples.

When there is an even number of terms, no Median actually exists. In this case it is possible to find two middle terms, and the Median is defined as the Mean of these two terms. A distribution may have no mode because no one term occurs more than once.

Because of the importance of the Mean as an indicator for locating a typical term in a distribution, we shall very briefly examine some properties of the Mean using a physical analogy.

Imagine a long board as shown in Figure II-1. Suppose five weights of one unit each are placed on this board in the positions corresponding to the distributions of numbers: 4, 4, 5, 7, 10. Now suppose we are told to find the balance point. This point is found only when we place the support under the point 6, which is the computed mean for the numbers. We say therefore, that the mean of any collection of terms is their balance point, and the mean is the only balance point. We may note that the sum of the distances of the weights from the mean is always the same on the left side as on the right side. With this in mind, let us display several columns of figures which enable us to see two properties of the mean.

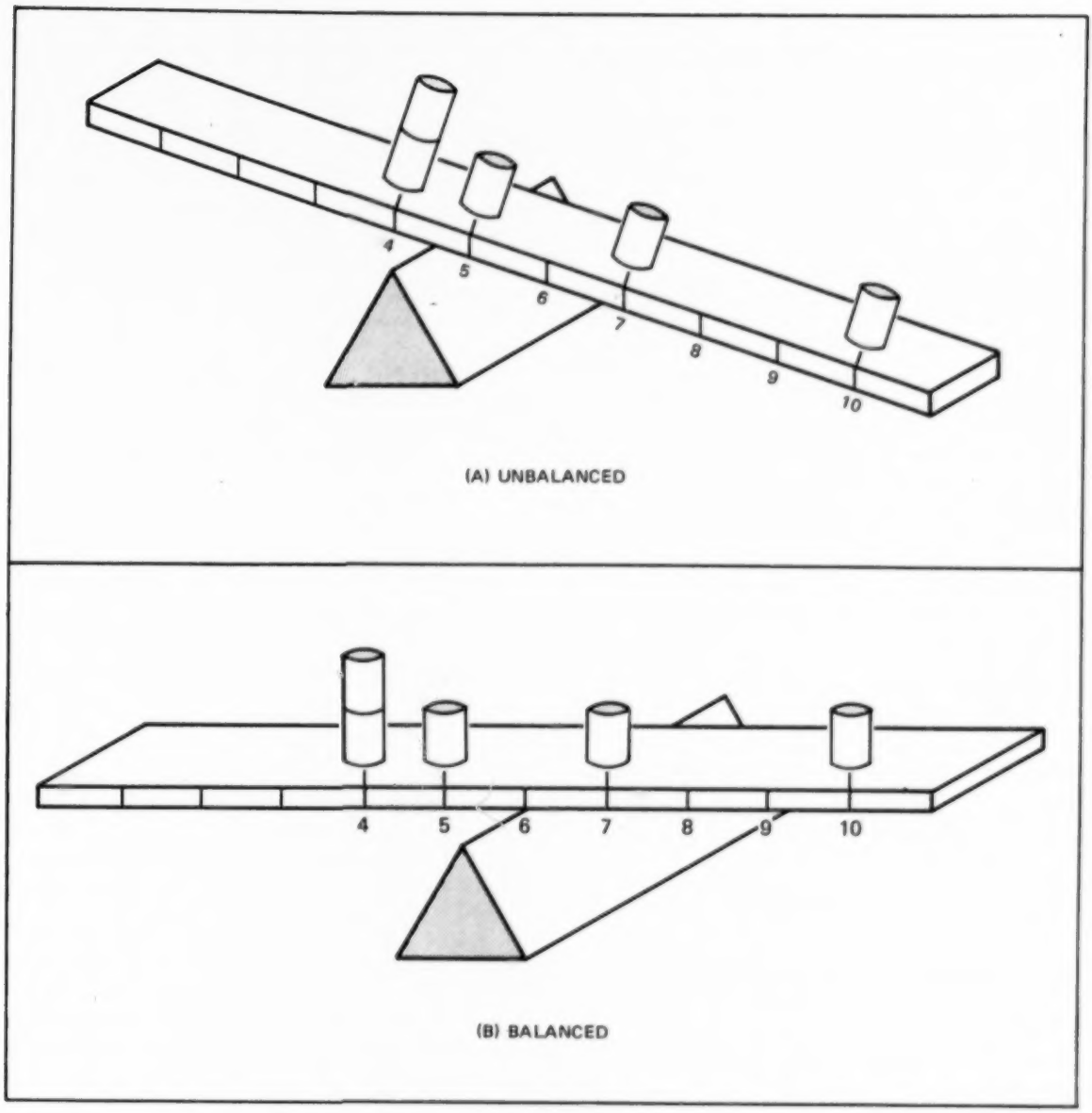


Figure II-1.

Terms in Dist.	Bal. Point (Mean)	Diff.	Sq. of Diff.	Test Bal. Pt.	Diff.	Sq. of Diff.
4	6	-2	4	5	-1	1
4	6	-2	4	5	-1	1
5	6	-1	1	5	0	0
7	6	+1	1	5	+2	4
10	6	+4	16	5	+5	25
		0	26		5	31

Note: (1) That by subtracting the balance point from each of the terms in the distribution we obtain a column of differences whose sum is zero (only the mean is the balance point). (2) That the sum of the squares of the differences is least for the mean as a balance point.

Quickly we observe that the mean equals the test balance point plus the average of the sum of the differences between this point and each term in the distribution. Further observations of this physical analogy could lead us to the following theorem: If each term of a distribution is increased, decreased or multiplied by a constant the mean is increased, decreased or multiplied by the same constant.

Using typical notation we may write: if X_i represents any term in a collection of N data points; M the Mean of the terms defined by $M = \frac{\Sigma X}{N}$, and K any constant which we may wish to add to each term, then the Mean (M_k) of the terms ($X_i + K$) is given by $M_k = M + K$.

If we multiply each X_i term by the constant K then, $M_k = K M$.

Also by using M' as a guessed mean and $d_i = X_i - M'$, we have $M = M' + \frac{\Sigma di}{N}$

When we are considering several distributions simultaneously it is convenient to use subscripts to avoid ambiguity. For instance, if we denote the data elements of a distribution A by X and those of a distribution E by Y then the formulas for the mean may take the form:

$$M_x = \frac{\Sigma X}{N_x}, \quad M_y = \frac{\Sigma Y}{N_y}$$

The Standard Deviation

We have seen that the Mean is the most sensitive measure for telling us where most of the data is concentrated, because it reflects the entire distribution. But, the mean says nothing about the terms of the distribution being close together or varying widely. At this point we are interested in how scattered or how clustered the terms may be in any given distribution. In other words, we seek to find a reliable measure of dispension of a distribution. The simplest measure or representation of this is the range—the difference between the largest and the smallest observations. Because of its simplicity it should be used whenever possible, however disadvantages arise out of its simplicity. First, only two of the observations in a sample are taken into account. Second, on the average it increases with sample size.

As a physical analogy of dispension or variability, consider two distributions.

Distribution A	Distribution B
8, 9, 10, 10, 13	1, 5, 10, 16, 18

Distributions A and B have the same Mean but the terms of A appear relatively clustered and those of B relatively scattered or spread apart.

Figure II-2 illustrates this very clearly. (See following page)

In studying variability, it is desirable to measure the scatter of all the observations, and not just that of the two extremes. This can be done by examining how much each observation differs from the average observation. As discussed earlier, if X_i is any term of a sample having N terms, then the deviation may be denoted by $x_i = X_i - M$. We observe that terms larger than the mean will produce positive deviations and those less than the Mean will be negative. The sum of these deviations is always zero if we consider negative signs. However, if we disregard negative signs and divide by the number of terms, after summing, a useful measure results.

Mean deviation = Sum of deviations/number of terms

$$M \text{ dev.} = \Sigma x_i/N$$

This measure is seldom used despite its computational simplicity, and a more standard measure is used in statistical theory.

Let us sum the squares of the deviations and divide the sum by the number of terms in the distribution so as to normalize our measure, and therefore purging it of the unwanted sensitivity to the number of terms in our

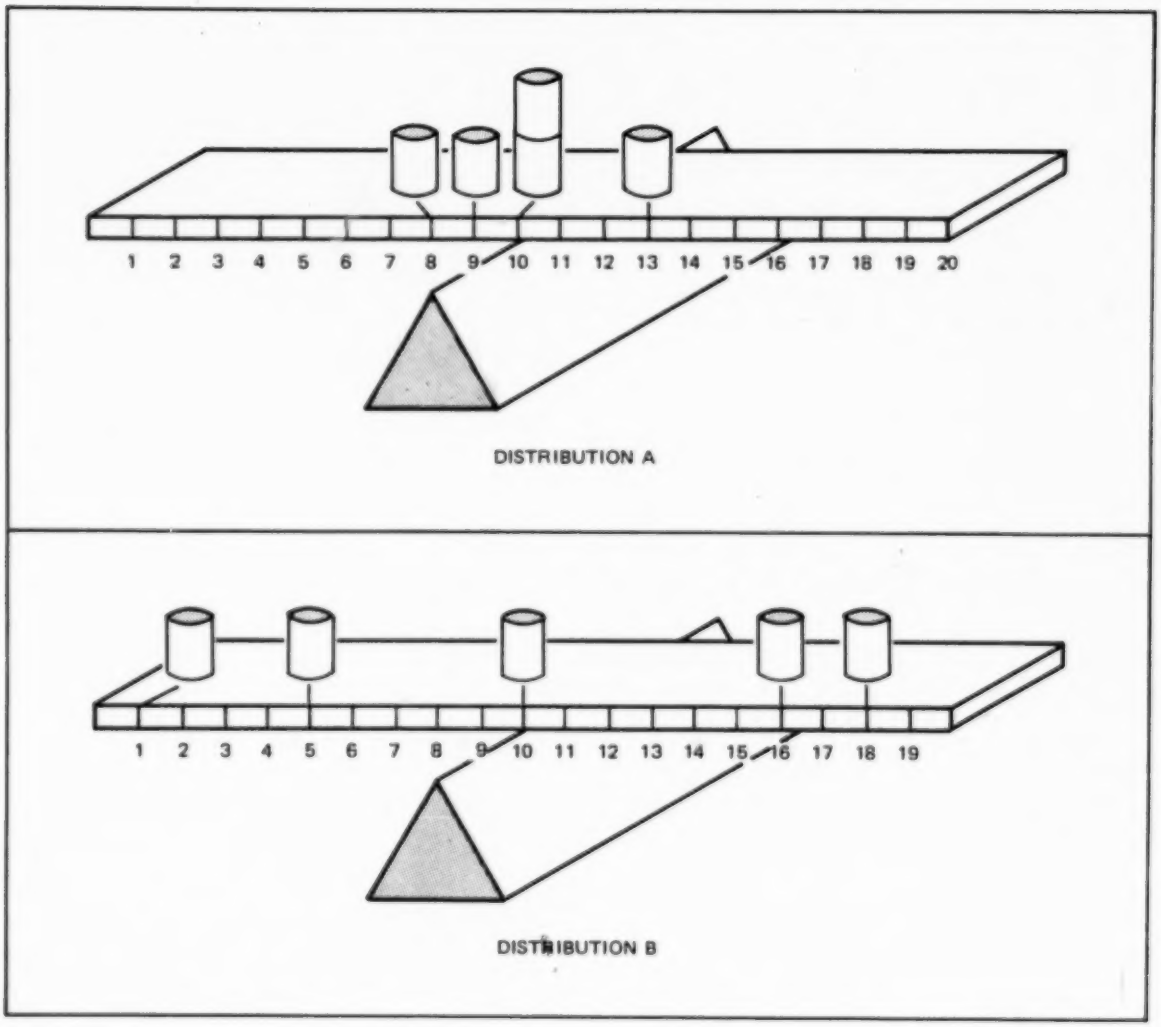

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
DISTRIBUTION A
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
DISTRIBUTION B

Figure II-2.

distribution. This quotient becomes a measure of variability and is called the *variance*. The variance may be defined as the mean of the squared differences from the mean of the distribution.

If we now go one step further and obtain the positive square root of the variance we then have a more familiar measure of dispersion which has all of the properties of the variance. This measure in statistics is called the Standard Deviation and has various uses in statistical work.

The standard deviation and variances are both small when the terms of a distribution are close together numerically, and large when the terms are widely scattered. Neither of these measures are related to the number of terms in the distribution. The variance and standard deviation only reflect the similarity or dissimilarity of the numbers themselves. Also, the measures of variability are independent of the mean. Observe that the distributions A and B, introduced earlier, have a mean value of 10, yet the standard deviation for A is 1.67 and that for B is 6.42—indicating that distribution B is much more scattered or tends to be greater distances from its mean than A. Thus we see that the standard deviation is a simple tool which tells us how concentrated our data is around the mean values. Simple formulas for computing standard deviation (SD) that are generally familiar:

$$\text{Variance (V)} = \Sigma (X_i - M)^2/N =$$

$$= \frac{1}{N} \Sigma X_i^2 - M^2$$

$$= \frac{1}{N} \Sigma X_i^2 - \left(\frac{\Sigma X_i}{N}\right)^2$$

$$\text{SD} = \sqrt{V}$$

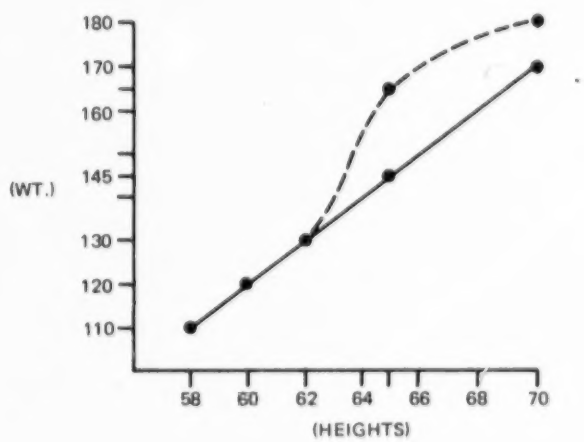
In our discussion of the Mean we consider the effect of adding a constant to each term in a distribution. It was clear from the picture analogy that adding a constant to each term simply shifts each weight some specified distance to the right, yet each weight preserves its original distance from the Mean. Thus we see that this shift leaves the variance and standard deviation unchanged.

On the other hand, multiplication of each term by a constant does affect the variability of a distribution. If the constant is a fraction, the values are pulled closer together. Thus multiplication of each term by a constant results in multiplication of the standard deviation by that constant and multiplication of the variance by the square of the constant.

Correlation

To examine the relationship between two corresponding data sets for the purpose of interpreting trends or establishing the validity of certain data, we introduce the concept of correlation. Graphically, we can illustrate correlation in its various forms before actually defining it. Consider the heights and weights of a population A of five men.

HEIGHT (IN.)	WEIGHT (LBS.)
58"	110
60"	120
62"	130
65"	145
70"	170



We note that as the heights increase so do the weights, and that for each 2 inches increase in height there is the corresponding 10 pounds increase in weight. This population is characterized by the fact that the correspondence between 2 inches and 10 pounds is uniform throughout. At this point we may say the notion of correlation refers not merely to a relationship, but particularly to one in which each unit change on one variable corresponds to some designated change in the other, and this correspondence is uniform.

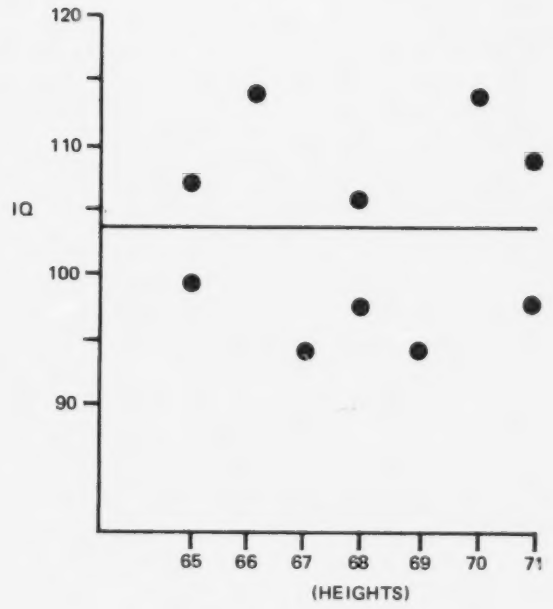
The case of the five weights and heights is one of perfect positive correlation because all five points lie on the same straight line. Nearly always we will find ourselves considering situations where some relationship exists, but far from perfect.

The degree to which two variables correlate is the degree to which a straight line comes close to containing all of the points representing the cases in a population.

If the fourth and fifth weights in our population A are replaced by 165 and 180 pounds respectively, we produce a case where the original correspondence breaks down in the last two terms.

However, there is a degree of positive correlation, but not the extreme case of perfect correlation. The straight line coming closest to fitting the modified data will possibly contain some of the data points, but certainly not all of them. This line is called the regression line. Suppose the data in our original population A had been characterized by a uniform decrease in weight for each unit increase in height, then a line through *all the data points* would be a straight line sloping downward to the right. We now have the extreme case of perfect negative correlation.

Before we give a formal definition of linear correlation we might consider a population B containing IQ scores and corresponding heights of ten people.



HEIGHTS (IN.)	IQ
65	107
65	99
66	114
67	94
68	98
68	106
69	94
70	114
71	108
71	98

We note from the data and the scatter diagram that as the heights increase there is no systematic change in the variable IQ. If we draw a straight line that comes closest to all the data points and it turns out to be a horizontal line as shown, then we have a case of no correlation between the variables height and IQ.

All of our illustrations have been aimed at (1) Conceptualizing that correlation is a special kind of linear relationship between two variables. (2) That correlation refers to the degree to which two variables move uniformly with respect to each other. (3) That perfect positive correlation should be viewed as one extreme, perfect negative correlations as the other extreme, and the case of no correlation as a central point. We now give a formal definition:[1]

Two variables are said to correlate positively when, as one variable increases, the other shows some trend to increase correspondingly in a uniform way. Two variables are said not to correlate at all when, as one of them changes, the other shows absolutely no over-all trend to change in a uniform way with respect to it. Two variables are said to correlate negatively when as one variable increases, the other shows some trend to decrease correspondingly in a uniform way.

[1] Weinberg and Schumaker, "Statistics—An Intuitive Approach," pp. 248, Brooks/Cole Publishing Co. Belmont, Calif., 1969.

Computing the Correlation Coefficient

In our discussion of the mean and standard deviation we examined some of the effects of shifting data by adding, multiplying or dividing each data element by a constant. As we consider formulas to compute correlation, we will see how our first two statistical indicators contribute to our correlation measure. The classic indicator of correlation is called the correlation coefficient. It is signified by the letter R or r and is a measure of the direction and strength of the correlation between two variables.

If we work from the original data to compute r, we may write, $r = \frac{1}{S_X S_Y}\left(\frac{\sum XY}{N} - M_X M_Y\right)$ where X and Y are the two variables, and M_X, S_X and M_Y, S_Y are the mean and standard deviation of X and Y respectively. We are assuming the use of this formula has already found the means and standard deviations of both variables.

If one desires to compute r only from the raw data, then a formula which looks more involved (yet is not) is used. The formula may be written as follows:

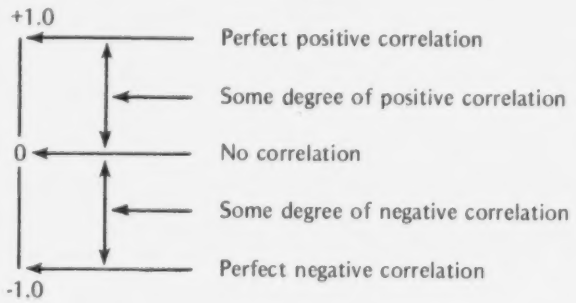
$$r = \frac{P_{xy}}{D_x \cdot D_y}$$

where, $P_{xy} = N\sum X \cdot Y - \left(\sum X\right)\left(\sum Y\right)$

$$D_x = \sqrt{N\sum X^2 - \left(\sum X\right)^2}$$

$$D_y = \sqrt{N\sum Y^2 - \left(\sum Y\right)^2}$$

The value of r will range from +1.0 for perfect positive correlation, to -1.0 for perfect negative correlation. Possible values of r may be diagramed as follows.



DATA PREPARATION AND ANALYSIS WORKBOOK

by

Charles Chambers
Clinton Jones
Lawrence Lezotte

INTRODUCTION

Workshop Units

The purpose of the workshop is to give you an opportunity to examine the various stages of data manipulation starting with data obtained in the initial collection phase and progressing to final interpretation. Because of the broad range of topics covered and the necessity to stagger your section with the other two, the workshop is divided into two sequential units. The first is entitled "Data Preparation" with the second being "Data Analysis".

Since it is necessary to organize the raw input from data collection before doing statistical analyses and making the appropriate interpretations, the first workshop unit is designed to demonstrate the several steps in this process. Specifically, you will start with various collections of data representative of a college administration, e.g. student records, financial, etc. Selected gauges for consistency and uniformity will then be applied in order to prepare the data. Finally, the principles of classification will be used to complete the data organization. The output of this unit will be a series of data analysis forms containing the demonstration data in a format compatible with statistical calculations.

The second workshop unit serves two functions. First, you will be given experience in obtaining various indicators which do not require cumbersome numerical calculations. These include types of tabulations such as frequency distribution, comparisons, trends, normalized profiles, projections, etc. Second, you will be briefed in the use of the computer assisted, terminal based, statistical model for making the more sophisticated calculations such as norms, standard deviations and correlations. In this unit, the theory of these indicators will be reviewed, and simplified methods for using desk calculators in the computations will be described and illustrated. Finally, while you will not actually do these analyses during this unit because of time limitations, you will organize a team problem based on data from other sessions. Then you can do your own statistical analyses on the computer terminals later in the institute.

The following pages describe your work materials and exercises.

I. Attached please find packets with the following items of administrative data.

A. Admissions questionnaires for 20 students containing the following data elements:

1. Last Name
2. Social Security Number
3. Zip Code (Geographic)
* 4. CEEB High School Code
5. Sex
6. Date of Birth
* 7. Class Rank
* 8. Cumulative GPA
* 9. Current Credit Hours
*10. (Financial Aid)

(*denotes non-student supplied items. Appears in an "office-use-only" section of form)

B. Master Social Security Number File for the audit trail

C. Personnel records for 16 staff members containing the following data elements:

1. Last Name
2. Social Security Number
3. Sex
4. Marital Status
5. Exemptions
6. Date of Birth (Julian Calendar)
7. Pay Scale
8. Schedule
9. Division
10. Position

II. Next, please organize and examine the data through the following procedures.

A. *Element Definition:* The smallest piece of information which can be cataloged or referenced, i.e. "What is the data item describing?"

B. Please, sort the student and personnel data alphabetically by last name and examine arrangement of each record on the enclosed data base map.
(Note: Field No. 1 is called the "sort field")

C. *Internal Validation:* The procedure of editing a field of data to insure that each element meets the parameters of the element definition. In our case, we can scan the columns vertically.

D. *Error Analysis:* If an error is suspected, we check the record of original entry, e.g., for students this is the questionnaire. If data is missing and only statistical analyses are being done then it is not usually worth trying to recover each item. If the missing data is replaced by the mean value of the remaining data, then the total mean value will be unchanged. However, the standard deviation will be decreased in magnitude. Why is this?
Of course, if the missing data is needed to make a decision about that particular person, then it *must* be recovered, e.g. if sex were missing and dormitory assignments were being made.

E. *External Validation:* The procedure of simultaneously editing more than one field of data to insure compatibility for comparison purposes, e.g. in preparing data for a correlation we must insure that each pair comes from the same record and are two data items about the same person.

F. Other MIS procedures we are not discussing:
1. File Maintenance (Housekeeping)
2. Processing
3. Output

G. *Test for Consistency:* It is usually impractical to test each data element by comparing with the record of original entry. Yet we do need some way to systematically check accuracy. We will describe and apply a stochastic test to accomplish this check.

Choose a data element:
1. If it is correct, skip two elements in the field (vertically) and check again.
2. If it is incorrect, check the next element in the field.

In general, if the data element is correct, double the previous skip; if incorrect, halve the previous skip.
Continue until the entire field has been scanned once, i.e. until we return to or past our starting point.
Our student number is given by the person's social security number. The social security number coding system has no check for internal consistency, e.g. there is no algorithm to verify whether or not 358-99-4687 is a valid social security number. Let us now verify our student file by using the master list, following the above procedure.

III. Please follow the instructions for laying out data on analysis sheets, performing various manual manipulations and preparing data for computer analysis.

A. *Lay out Sheets:* There are two types of lay out sheets attached. The first is designed to facilitate the calculation of statistical norms by arranging the sum of elements, the sum of their squares and the sum of their products. The second is designed to facilitate the tabulation of frequency distributions, etc.

B. *Typical Analyses:* Depending on available time, the following are illustrative types of computations you may perform.
1. Classload; Mean Value and Standard Deviation.
* 2. Age; Mean Value and Standard Deviation.
3. Distribution of Class by Age.
4. Distribution of Students by Credit Hours.
5. Correlation between class rank and GPA.
6. Distribution of Students Geographically (Zones).
7. Some types of data can't be compared directly, e.g., number of female freshmen vs. number of female sophomores. In such cases we normalize the data by the size of the total groups and compare percentages; in this case, percentage of sex by class.
8. We can also use percentages of total enrollment by class to make projections and estimates. For example, assume we have

1,000 students as follows: 400 freshmen, 300 sophomores, 200 juniors and 100 seniors. We ask: If the freshman class increases 20% next year, what will be the class populations and total enrollment, assuming the same distribution among classes?

	This Year		Next Year	
Class	Number	Percent	Number	Percent
F	400	40%	(480)	40%
S	300	30%	(360)	30%
J	200	20%	(240)	20%
S	100	10%	(120)	10%
T	1,000	100%	(1,200)	100%

The numbers in parenthesis were derived as follows:

Number of next year's freshmen equals (100% + 20%) times 400 equals 120% times 400 equals 480.

Total next years enrollment times 40% equals 480; or total next year's enrollment equals 480 divided by 40% equals 1,200.

Number of next year's sophomores equals 30% times 1,200 equals 360.

Number of next year's juniors equals 20% times 1,200 equals 240.

Number of next year's seniors equals 10% times 1,200 equals 120.

9. Percentage Analysis of Attrition.

10. Similar exercises for personnel file.

(Note: * denotes a calculation based on the Julian Calendar. This calendar measures total days elapsed since an arbitrary point in history. For example, 2,428,360 denotes January 1, 1940. We add 365 for each regular year and 366 for each leap year. Julian dates can be added and manipulated like other numerical data.)

REGISTRATION RECORD

1. Last Name SHERMAN 2. Sex M
3. Social Security Number 109-49-8801
4. Zip Code 27561 5. Date of Birth 2/9/53

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 2.98
8. Current Credit Hours 16
9. CEEB High School Code 2756
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name WILSON 2. Sex F
3. Social Security Number 290-34-4145
4. Zip Code 40159 5. Date of Birth 11/18/47

OFFICE-USE-ONLY

6. Class Rank 4 7. Cummulative GPA 2.17
8. Current Credit Hours 15
9. CEEB High School Code 4016
10. Financial Aid N

REGISTRATION RECORD

1. Last Name TAYLOR 2. Sex M
3. Social Security Number 725-57-6722
4. Zip Code 35872 5. Date of Birth 8/10/50

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 3.07
8. Current Credit Hours 18
9. CEEB High School Code 3587
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name YOUNG 2. Sex F
3. Social Security Number 620-26-8796
4. Zip Code 28536 5. Date of Birth 5/17/53

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 3.95
8. Current Credit Hours 16
9. CEEB High School Code 2854
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name FIELDS 2. Sex M
3. Social Security Number 422-01-0719
4. Zip Code 22051 5. Date of Birth 1/9/51

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 2.00
8. Current Credit Hours 15
9. CEEB High School Code 2205
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name HARRISON 2. Sex M
3. Social Security Number 399-87-4256
4. Zip Code 34667 5. Date of Birth 7/26/50

OFFICE-USE-ONLY

6. Class Rank 2 7. Cummulative GPA 1.75
8. Current Credit Hours 16
9. CEEB High School Code 3467
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name GRANT 2. Sex M
3. Social Security Number 424-55-5279
4. Zip Code 31029 5. Date of Birth 3/19/51

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 3.50
8. Current Credit Hours 9
9. CEEB High School Code 3103
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name HOGAN 2. Sex F
3. Social Security Number 323-24-3610
4. Zip Code 39891 5. Date of Birth 6/27/46

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 2.75
8. Current Credit Hours 14
9. CEEB High School Code 3989
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name NELSON 2. Sex F
3. Social Security Number 667-15-8754
4. Zip Code 26387 5. Date of Birth 7/14/45

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 2.00
8. Current Credit Hours 12
9. CEEB High School Code 2639
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name PERKINS 2. Sex F
3. Social Security Number 427-78-3233
4. Zip Code 40021 5. Date of Birth 9/16/50

OFFICE-USE-ONLY

6. Class Rank 4 7. Cummulative GPA 3.25
8. Current Credit Hours 16
9. CEEB High School Code 4002
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name PAYNE 2. Sex M
3. Social Security Number 812-08-0152
4. Zip Code 39586 5. Date of Birth 11/18/49

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 3.50
8. Current Credit Hours 20
9. CEEB High School Code 3959
10. Financial Aid N

REGISTRATION RECORD

1. Last Name REED 2. Sex M
3. Social Security Number 601-61-6197
4. Zip Code 26154 5. Date of Birth 3/7/47

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 1.50
8. Current Credit Hours 18
9. CEEB High School Code 2615
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name AVERY 2. Sex F
3. Social Security Number 362-38-6859
4. Zip Code 30792 5. Date of Birth 5/4/51

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 2.75
8. Current Credit Hours 16
9. CEEB High School Code 3079
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name BOYD 2. Sex F
3. Social Security Number 070-39-2791
4. Zip Code 28536 5. Date of Birth 11/9/45

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 2.35
8. Current Credit Hours 17
9. CEEB High School Code 2854
10. Financial Aid N

REGISTRATION RECORD

1. Last Name BEACH 2. Sex M
3. Social Security Number 591-72-4236
4. Zip Code 27561 5. Date of Birth 12/8/49

OFFICE-USE-ONLY

6. Class Rank 2 7. Cummulative GPA 2.75
8. Current Credit Hours 18
9. CEEB High School Code 2756
10. Financial Aid N

REGISTRATION RECORD

1. Last Name CLARKE 2. Sex F
3. Social Security Number 168-16-8413
4. Zip Code 31029 5. Date of Birth 12/25/50

OFFICE-USE-ONLY

6. Class Rank 4 7. Cummulative GPA 2.25
8. Current Credit Hours 15
9. CEEB High School Code 3103
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name JOHNSON 2. Sex F
3. Social Security Number 877-19-7204
4. Zip Code 26154 5. Date of Birth 10/14/54

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 3.00
8. Current Credit Hours 15
9. CEEB High School Code 2615
10. Financial Aid N

REGISTRATION RECORD

1. Last Name MARSH 2. Sex M
3. Social Security Number 304-66-5297
4. Zip Code 31029 5. Date of Birth 9/30/51

OFFICE-USE-ONLY

6. Class Rank 2 7. Cummulative GPA 1.50
8. Current Credit Hours 16
9. CEEB High School Code 3103
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name JOHNSON 2. Sex M
3. Social Security Number 009-97-1108
4. Zip Code 39891 5. Date of Birth 3/21/53

OFFICE-USE-ONLY

6. Class Rank 1 7. Cummulative GPA 2.50
8. Current Credit Hours 16
9. CEEB High School Code 3989
10. Financial Aid Y

REGISTRATION RECORD

1. Last Name MOORE 2. Sex M
3. Social Security Number 528-28-6692
4. Zip Code 26154 5. Date of Birth 2/16/49

OFFICE-USE-ONLY

6. Class Rank 3 7. Cummulative GPA 2.85
8. Current Credit Hours 18
9. CEEB High School Code 2615
10. Financial Aid Y

MASTER FILE
SOCIAL SECURITY NUMBERS
STAFF

1. 228-02-9601
2. 222-51-5219
3. 927-46-1971
4. 664-38-4872
5. 492-66-5687
6. 529-84-7296
7. 966-92-6165
8. 003-29-6197
9. 304-68-3827
10. 014-15-7214
11. 637-92-8431
12. 814-19-7279
13. 578-72-4241
14. 635-77-1329
15. 372-15-4596
16. 429-55-5861

MASTER FILE
SOCIAL SECURITY NUMBERS
STUDENTS

1. 424-55-5278
2. 667-15-8754
3. 070-39-2791
4. 009-97-1108
5. 109-49-8801
6. 877-19-7204
7. 304-66-5297
8. 591-72-4236
9. 427-78-3233
10. 725-57-6722
11. 362-38-6859
12. 323-24-3610
13. 168-16-2791
14. 601-61-6197
15. 422-01-0719
16. 290-34-4145
17. 399-87-4256
18. 528-28-6692
19. 620-26-8796
20. 812-08-0152

PAYROLL RECORD

1. Last Name MILLER 2. Sex F

3. Social Security Number 578-72-4241

4. Date of Birth 2,427,381 Julian

5. Marital Status M 6. Exemptions 8

7. Pay Scale 8 8. Schedule 10

9. Division 2 10. Position PROF.

PAYROLL RECORD

1. Last Name ROBERTS 2. Sex M

3. Social Security Number 664-38-4872

4. Date of Birth 2,432,611 Julian

5. Marital Status M 6. Exemptions 2

7. Pay Scale 3 8. Schedule 12

9. Division 4 10. Position CLERK

PAYROLL RECORD

1. Last Name OWENS 2. Sex M

3. Social Security Number 429-55-5861

4. Date of Birth 2,420,178 Julian

5. Marital Status S 6. Exemptions 1

7. Pay Scale 5 8. Schedule 12

9. Division 4 10. Position MAINT.

PAYROLL RECORD

1. Last Name SHAW 2. Sex M

3. Social Security Number 312-15-4596

4. Date of Birth 2,428,179 Julian

5. Marital Status M 6. Exemptions 4

7. Pay Scale 6 8. Schedule 10

9. Division 3 10. Position PROF.

PAYROLL RECORD

1. Last Name BRADY 2. Sex F

3. Social Security Number 529-84-7296

4. Date of Birth 2,429,971 Julian

5. Marital Status M 6. Exemptions 5

7. Pay Scale 4 8. Schedule 10

9. Division 2 10. Position SEC.

PAYROLL RECORD

1. Last Name CLARK 2. Sex F

3. Social Security Number 492-66-5687

4. Date of Birth 2,429,378 Julian

5. Marital Status S 6. Exemptions 2

7. Pay Scale 3 8. Schedule 12

9. Division 1 10. Position SEC.

PAYROLL RECORD

1. Last Name BUTLER 2. Sex M

3. Social Security Number 637-92-8431

4. Date of Birth 2,426,791 Julian

5. Marital Status M 6. Exemptions 2

7. Pay Scale 10 8. Schedule 12

9. Division 1 10. Position PRES.

PAYROLL RECORD

1. Last Name COX 2. Sex M

3. Social Security Number 014-15-7214

4. Date of Birth 2,426,178 Julian

5. Marital Status S 6. Exemptions 3

7. Pay Scale 7 8. Schedule 12

9. Division 3 10. Position COACH

PAYROLL RECORD

1. Last Name DENTON 2. Sex M

3. Social Security Number 228-02-9601

4. Date of Birth 2,424,695 Julian

5. Marital Status S 6. Exemptions 1

7. Pay Scale 9 8. Schedule 12

9. Division 2 10. Position DEAN

PAYROLL RECORD

1. Last Name KNOX 2. Sex F

3. Social Security Number 927-46-1971

4. Date of Birth 2,424,178 Julian

5. Marital Status M 6. Exemptions 2

7. Pay Scale 9 8. Schedule 12

9. Division 1 10. Position TREAS.

PAYROLL RECORD

1. Last Name HARDY 2. Sex M

3. Social Security Number 635-77-1329

4. Date of Birth 2,427,831 Julian

5. Marital Status M 6. Exemptions 4

7. Pay Scale 8 8. Schedule 10

9. Division 2 10. Position PROF.

PAYROLL RECORD

1. Last Name LAWSON 2. Sex M

3. Social Security Number 003-29-6197

4. Date of Birth 2,430,871 Julian

5. Marital Status M 6. Exemptions 3

7. Pay Scale 7 8. Schedule 10

9. Division 3 10. Position PROF.

PAYROLL RECORD

1. Last Name SMITH 2. Sex M

3. Social Security Number 814-19-7279

4. Date of Birth 2,428,019 Julian

5. Marital Status S 6. Exemptions 1

7. Pay Scale 6 8. Schedule 10

9. Division 2 10. Position PR'OF.

PAYROLL RECORD

1. Last Name WARDEN 2. Sex F

3. Social Security Number 304-68-3827

4. Date of Birth 2,428,795 Julian

5. Marital Status S 6. Exemptions 1

7. Pay Scale 5 8. Schedule 12

9. Division 4 10. Position LIBR'N

PAYROLL RECORD

1. Last Name UNGER 2. Sex M

3. Social Security Number 966-92-6165

4. Date of Birth 2,426,513 Julian

5. Marital Status M 6. Exemptions 6

7. Pay Scale 6 8. Schedule 12

9. Division 1 10. Position REGIS'TR

PAYROLL RECORD

1. Last Name WICKS 2. Sex M

3. Social Security Number 222-51-5219

4. Date of Birth 2,425,979 Julian

5. Marital Status M 6. Exemptions 3

7. Pay Scale 7 8. Schedule 12

9. Division 1 10. Position ADMISS.

DATA BASE MAP

FILE NAME _____ PAGE ____

Record	Field									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

FILE NAME _____

Title										
Code										
Notes										
	1	2	3	4	5	6	7	8	9	10

Legend – Data Base Map

ORDERED DATA (SORT)
TABULATIONS & FREQUENCY DISTRIBUTIONS

Item	Value	
1. File Name	_____	
2. Field Heading	_____	
3. Number of Records	_____	
4. Mean Value	_____	if available
5. Standard Deviation	_____	
6. Maximum Value	_____	
7. – Minimum Value	_____	
8. = File Width	_____	
9. ÷ Number of intervals	_____	
10. = Approximate Interval	_____	
11. ≈ Interval (Rounded)	_____	
12. Low Point (Equals the minimum value minus the interval rounded to the same scale as the interval)	_____	
13. Median Value (Equals the minimum value plus one half the file width)	_____	
14. High Point (Equals the interval size times their number plus the low point)	_____	

LAYOUT FORM

Sorted File		Interval Breakpoints	Counter
Record	Value		
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

STATISTICAL ANALYSIS FORM

Index	x	y	x^2	y^2	xy
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
NO	Sum x	Sum y	Sum x^2	Sum y^2	Sun xy

COMPUTATIONS

MEAN VALUE

1. (Sum x) ÷ NO = Mx = _____

1. (Sum y) ÷ NO = My = _____

STANDARD DEVIATION

1. (Sum x^2) ÷ NO = _____
2. -Mx = -_____
3. = Vx = _____
4. $\sqrt{Vx}$ = Sx = _____

1. (Sum y^2) ÷ NO = _____
2. -My = -_____
3. = Vy = _____
4. $\sqrt{Vy}$ = Sy = _____

CORRELATION COEFFICIENT

1. (Sum xy) ÷ NO = _____
2. -MxMy = _____
3. = D = _____
4. SxSy = _____
5. R = D ÷ SxSy = _____

Section III
REMOTE DATA ACCESS

Abstract

The Meharry Computer Center (Nashville, Tennessee) was the scene for the third session of the Summer Institute concerning remote data access. This session was an emphasis of the previous two day's sessions, data collection and manipulation. Remote Data Access was introduced to the college participants as a "state of the art" method of collecting and manipulating data using automated procedures. Even though most of the institutions represented at the Summer Institute do not have computers resident at their institutions, we felt that to **not** *introduce this concept to them would have been a tragedy. For those participants representing institutions that* **did** *have computer configurations, new ways and means of handling information in a more sophisticated manner were conveyed. Both concepts were introduced, but our primary thrust was a procedural one, which the participants could work out manually, or by machine, when speed was a factor. Each of the groups were given lectures on time-sharing (simultaneous use of the computers via remote terminals), BASIC (the fundamental computer language for time-share uses), and a demonstration session on the terminals whereby they were able to access data concerning their particular institutions, as well as getting a feel for some BASIC programs and techniques in using the terminals and language.*

A manual was developed for the Summer Institute, entitled "Remote Operation of a Time-Sharing Computer."[5] Sections of the manual are included herein. This manual was used as a guide for the participants in how to use the terminals provided. In addition, some BASIC programs were provided so that the participants could see how reports are generated on time-shared equipment. Two keyboard layouts are provided, as well as flow charts showing some basic functions that are performed by the BTM (Batch Time-Sharing Monitor) system of the Xerox Sigma 7 Computer—resident at Meharry.

Storing procedures were worked into the Manipulation and Remote Data Access Sessions, as well as the Reporting session so that the participants could gain an understanding of automated--magnetic tapes, disks, and drums—as well as manual storing devices—ledgers.

Terminals, as a management tool, provide an institution with most of the conveniences one finds in having a computer, but without actually absorbing the cost of having an in-house computer configuration. However, recognizing that a large portion of the institutions represented do not have computers or time-shared equipment, development of a good sound manual procedure, it was emphasized, would be just as effective. What follows is an introduction to the "Remote Operation of a Time-Sharing Computer," for the Xerox Data Systems Sigma 7. Though the references are specific, the principals of operation are basic to most computing systems.

REMOTE OPERATION OF A TIME-SHARING COMPUTER

by

The Staff of the
Meharry Medical College Computer Center
Nashville, Tennessee

REMOTE OPERATION OF COMPUTERS

The Teletype 35 Terminals used in this course are linked to the Meharry Computer Center. The signals which originate from the terminal are relayed through the telephone system and are then coupled directly into one of the Time Sharing Computers at Meharry; in this case a Xerox Data Systems Sigma 7 Computer. This form of remote operation of a computer places a very powerful computer tool in the hands of any establishment which sets up a remote terminal operation. Any of the normal computer job mix can be processed using a remote terminal with little or no loss of computing speed. The input and the output speeds are of course limited by the type of terminal being used at the remote end, but a wide range of different types of terminals with speeds up to 300 characters per second are available.

The Teletype 35 Remote Terminal has a maximum transmission speed of 10 characters per second which is approximately 120 words a minute, a fast typist speed. The terminal is only connected to the computer when it is being used, so no computer time is being wasted during unconnected periods. Files can be constructed by the use of a terminal; these files can then be modified, records added or deleted; programs can be entered and executed using data either keyed in directly or called from a stored file already existing in the computer. The output may be to the input terminal or it may be routed to the high speed printer at the Computer Center.

To activate a TTY 35 from a remote terminal:

Depress and hold the keys "CTRL" and "SHIFT" simultaneously with the left hand, then hit "K" twice with the right hand.*

When contact is made with the Sigma 7 a message will be typed on the TTY.

Meharry BTM System
xx / xx / xx (Date) xx : xx (Time)
! Login

*See page 72 for Alternative Keyboard.

Each user must have an authorized account number in order to create and use files. An authorized account number consists of 2 parts, a five digit number followed by a comma (,) and a three digit number. After ! LOGIN, type in your account number. If your account number is accepted the computer will reply with an ID character and an exclamation mark !

The above actions are controlled by the Executive system of the Sigma 7. The user may now choose the subsystem he wishes from the set listed below:

- **BASIC**—A programming system used to write computer programs for solving a variety of numerical problems.
- **FORTRAN**—A programming system for writing, compiling and executing FORTRAN programs from on-line terminals.
- **EDIT**—A subsystem for building data files on the Sigma 7 Rapid Access Disk. These files may be used with source programs built under BASIC and FORTRAN.
- **LOAD**—A subsystem to cause a program to be loaded from a previously created file.
- **ASSIGN**—Causes information on input and output to be transmitted to the computer.

The user may escape from any of these subsystems and return to the Executive by depressing "CTRL" and "SHIFT" and hitting "K" twice (in basic 4 "K"'s are required to return to the monitor). The computer will respond with ! to indicate the return has been accepted.

Each of the above subsystems is called by typing the first two letters of the title and the computer responds by completing the word. For example, type BA and the computer returns with SIC.

To sign off from the terminal the user returns to the Executive and in response to ! types BY. The computer response is to give the time used by the user.

Examples of each subsystem follow.

```
!BASIC
>LOAD SAMPLE
>LIST
5 PRINT'THIS PROGRAM FINDS THE SMALLEST OF SIX NUMBERS'
7 PRINT 'WHAT ARE YOUR NUMBERS';
10 INPUT A(1),A(2),A(3),A(4),A(5),A(6)
20 LET S = A(1)
30 FOR I = 2 TO 6
40 IF S<A(I) GO TO 60
50 LET S = A(I)
60 NEXT I
70 PRINT'THE SMALLEST NUMBER IS';S
80 END
>RUN
22:17   07/11
THIS PROGRAM FINDS THE SMALLEST OF SIX NUMBERS
WHAT ARE YOUR NUMBERS   ?389576
?25364
?47590
?46243
?45678
?4561
THE SMALLEST NUMBER IS    4561


80 HALT
>SYS

!BYE
07/11/   '72 22:18
CPU TIME 0.028
I/O WAIT TIME 0.014
MON SERVICES 0.013
```

```
'
MEHARRY BTM SYSTEM
07/11/   '72 18:50
!LOGIN: 77777,001
ID= N
!EDIT
*DELETE MSDATA1
..DELETED
*DELETE MSDATA
..DELETED
*BUILD MSDATA
    1.000 (F3.0)
    2.000 358
    3.000 461
    4.000 372
    5.000 763
    6.000 560
    7.000 549
    8.000 639
    9.000 749
   10.000 472
   11.000 572
   12.000 731
   13.000 476
   14.000 751
   15.000 427
   16.000
*END

!LOAD
ELEMENT FILES: MR_SROM
OPTIONS:
F:5=MSDATA,IN
F:6
F:

SEV.LEV. = 0
XEQ? Y

                PREPARED BY MEHARRY COMPUTER CENTER
              COMPUTE THE MEAN AND STANDARD DEVIATION
                 7880.000 SUM OF THE VARIABLES
              4702796.000 SUM OF THE VARIABLES SQUARED
                  562.857 MEAN OF THE VARIABLES
                  138.224 STANDARD DEVIATION OF THE VARIABLES
!
 *EXIT

!BYE
07/11/   '7
```

```
!
MEHARRY BTM SYSTEM
07/11/  '72 20:26
!LOGIN: 77777,100
ID= N
!ASSIGN M:SI,(FILE,MSPROG)

!FORTRAN
OPTIONS: BO
  EXTENDED FIV-H VERSION D00

** END OF COMPILATION **

!LOAD
ELEMENT FILES:
OPTIONS:
F:5=MSTEST,IN
F:6
F:

SEV.LEV. = 0
XEQ? Y

              PREPARED BY MEHARRY COMPUTER CENTER
            COMPUTE THE MEAN AND STANDARD DEVIATION
              24085.000 SUM OF THE VARIABLES
            7235175.000 SUM OF THE VARIABLES SQUARED
                256.223 MEAN OF THE VARIABLES
                106.393 STANDARD DEVIATION OF THE VARIABLES
1
 *EXIT*

!BYE
07
DISC
```

```
!
MEHARRY BTM SYSTEM
07/11/   '72 20:31
!LOGIN: 77777,100
ID= N
!LOAD
ELEMENT FILES: MSROM
OPTIONS:
F:5
F:6
F:

SEV.LEV. = 0
XEQ? Y

?(F3.0)
?111
?222
?333
?444
?555
?123
?456
?789
?150
?!EOD
                PREPARED BY MEHARRY COMPUTER CENTER
              COMPUTE THE MEAN AND STANDARD DEVIATION
                 3183.000 SUM OF THE VARIABLES
              1545741.000 SUM OF THE VARIABLES SQUARED
                  353.667 MEAN OF THE VARIABLES
                  216.030 STANDARD DEVIATION OF THE VARIABLES
1
?!EOD
 *EXIT*

!BYE
07/11
CPU TI
```

```
     BTM SYSTEM
07/11/   '72 21:03
!LOGIN: 77777,100
ID= N
!LOAD
ELEMENT FILES:-REPORT
OPTIONS:
F:11=FILE11,IN
F:12=FILE12,IN
F:14=FILE14,IN
F:6
F:

SEV.LEV. = 0
XEQ?




LIST OF PARTICIPATING INSTITUTIONS:-
  1002 INSTITUTION 1     13
  1044 INSTITUTION 2     22
  1590 INSTITUTION 3     13
  1968 INSTITUTION 4     12
  2410 INSTITUTION 5     13
  2950 INSTITUTION 6     14
  3497 INSTITUTION 7     23
  3506 INSTITUTION 8     26
LIST OF REPORTS AVAILABLE:-
 1. ENROLLMENT
 2. INSTRUCTIONAL FACILITIES
 3. SUPPORT FACILITIES
 4. REVENUE BY SOURCE
 5. EXPENDITURE BY SOURCE
PLEASE SELECT THE INSTITUTION & CLUSTER CODE AND TYPE IN
XXXX-XX FORMAT
?1002-13
IS THIS CORRECT?
?YES
PLEASE SELECT THE REPORT NO.
?1
```

INSTITUTION: INSTITUTION 1

CLUSTER NO: 13
TACTICS NO: 1002

REPORT NO 1A: ENROLLMENT BY CLASSIFICATION AND SEX WITH ANNUAL PERCENTAGE CHANGE

		1966	TREND	1967	TREND	1968
PART TIME						
	MEN	7	885	69	-14	59
	WOMEN	6	533	98	2	100
	TOTAL	13	184	167	-4	159
FULL TIME						
	MEN	681	10	752	4	789
	WOMEN	1051	9	1152	-2	1128
	TOTAL	1732	9	1904	0	1917
FIRST TIME						
	MEN	238	0	237	-2	231
	WOMEN	318	-2	310	-2	303
	TOTAL	556	-1	547	-2	534

NOTE: TREND EQUALS PERCENTAGE CHANGE BETWEEN TWO CONSECUTIVE YEARS

ANY MORE REPORTS?
?YES
PLEASE SELECT THE INSTITUTION & CLUSTER CODE AND TYPE IN XXXX-XX FORMAT
?1002-13
IS THIS CORRECT?
?YES
PLEASE SELECT THE REPORT NO.
?2

INSTITUTION: INSTITUTION 2

CLUSTER NO: 22
TACTICS NO: 1044

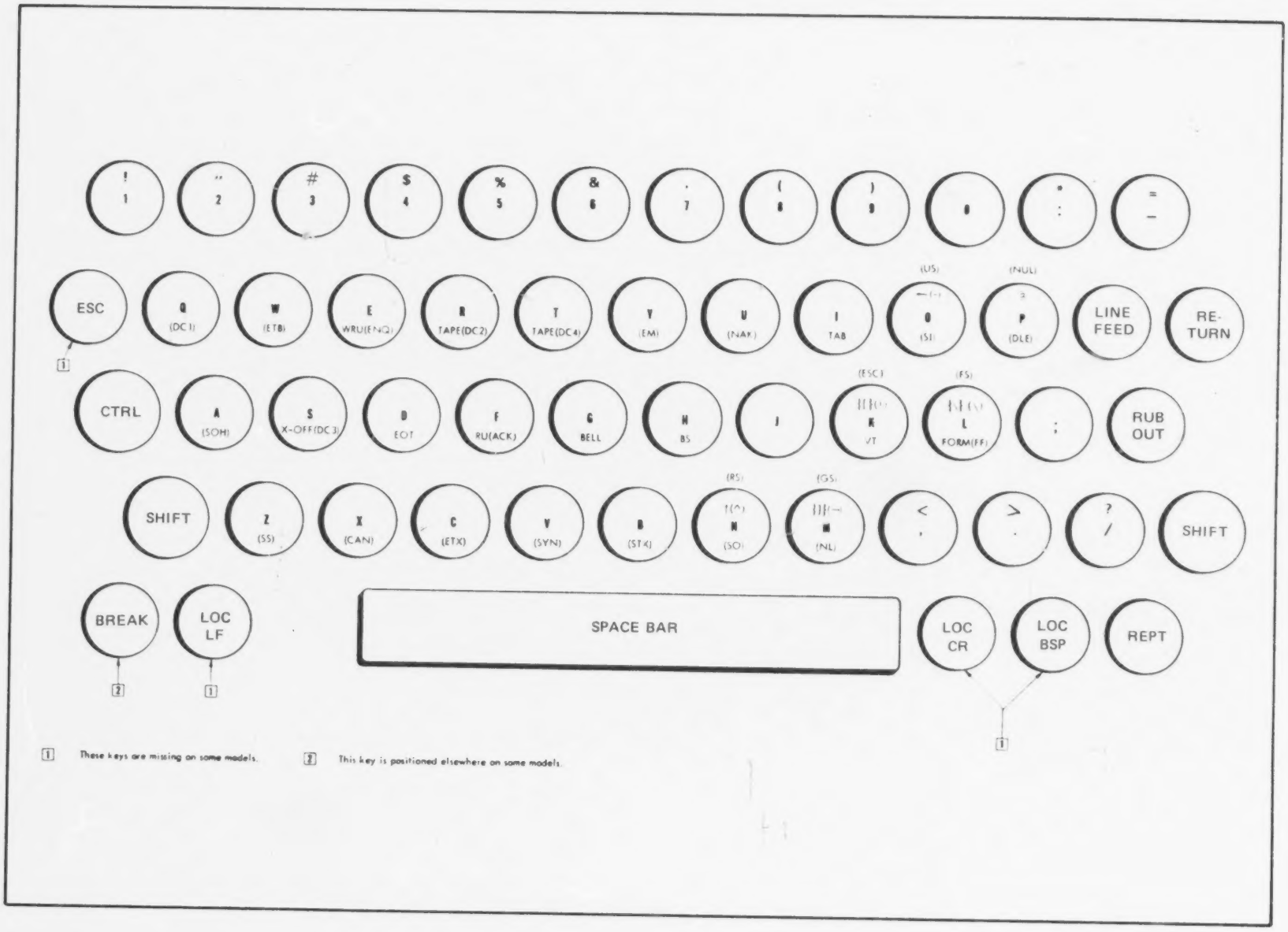
REPORT NO. 16: EXPENDITURES BY FUNCTION WITH ANNUAL PERCENTAGE CHANGES

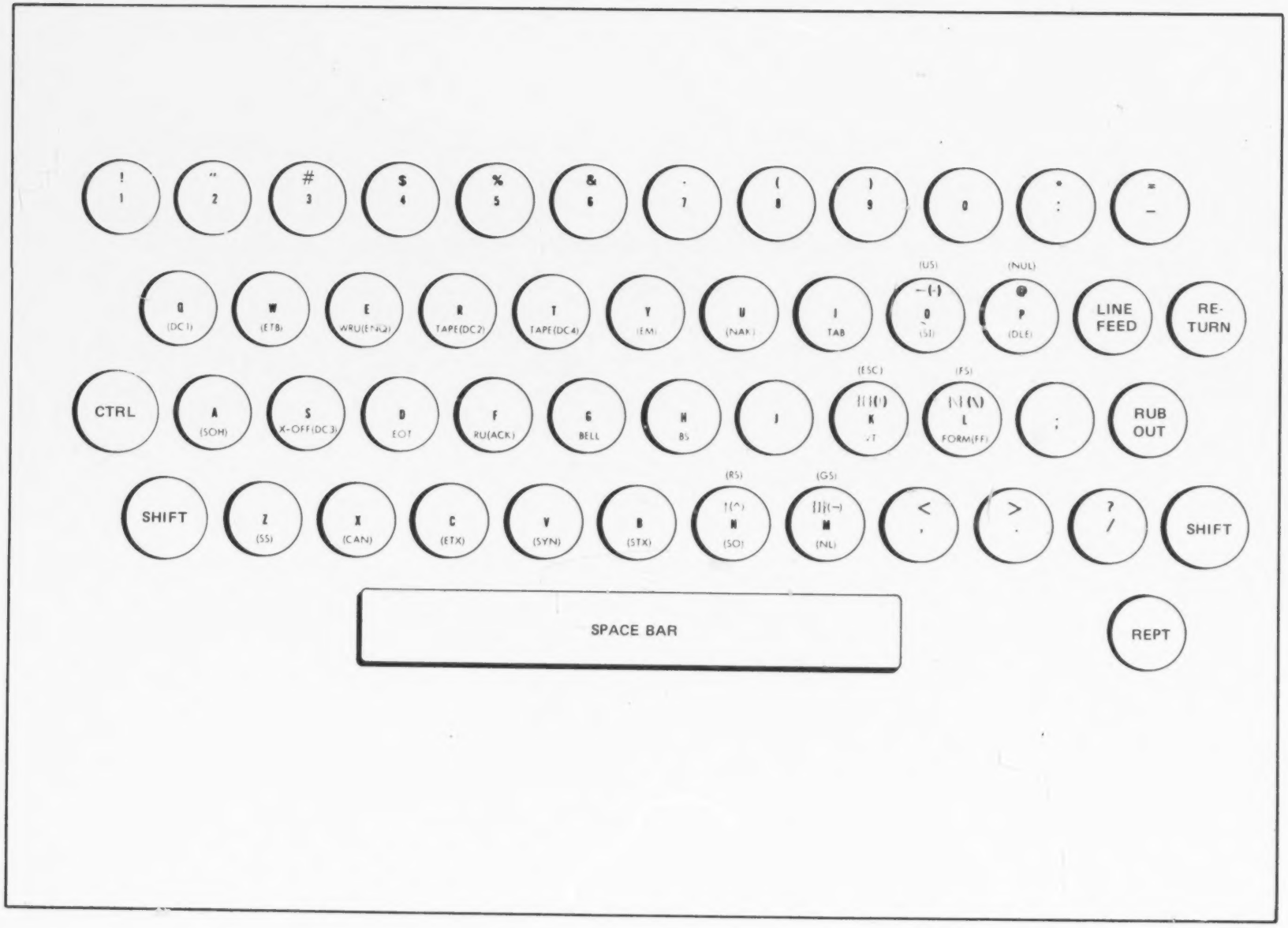
($1000 UNITS)

	1967	TREND	1968	TREND	1969
EDUCATIONAL AND GENERAL	867	8	940	41	1330
STUDENT AID	247	9	271	4	282
SERVICE PROGRAMS	0	0	0	0	0
AUXILIARY	266	0	265	39	369
TOTAL EXPENDITURES	1380	6	1476	34	1981

NOTE: TREND EQUALS PERCENTAGE CHANGE BETWEEN TWO CONSECUTIVE YEARS

ANY MORE REPORTS?
?NO
END OF JOB
STOP 0


! 1
" 2
3
$ 4
% 5
& 6
' 7
(8
) 9
0
*
:
=
-
ESC
Q (DC1)
W (ETB)
E WRU(ENQ)
R TAPE(DC2)
T TAPE(DC4)
Y (EM)
U (NAK)
I TAB
(US)
O (SI)
(NUL)
P (DLE)
LINE FEED
RE-TURN
CTRL
A (SOH)
S X-OFF(DC3)
D EOT
F RU(ACK)
G BELL
H BS
J
(ESC)
K VT
(FS)
L FORM(FF)
;
RUB OUT
SHIFT
Z (SS)
X (CAN)
C (ETX)
V (SYN)
B (STX)
(RS)
N (SO)
(GS)
M (NL)
<
,
>
.
?
/
SHIFT
BREAK
LOC LF
SPACE BAR
LOC CR
LOC BSP
REPT
1
2
1
1
1 These keys are missing on some models.
2 This key is positioned elsewhere on some models.


! 1
" 2
3
$ 4
% 5
& 6
' 7
(8
) 9
0
*
:
=
-
Q
(DC1)
W
(ETB)
E
WRU(ENQ)
R
TAPE(DC2)
T
TAPE(DC4)
Y
(EM)
U
(NAK)
I
TAB
(US)
O
(SI)
(NUL)
P
(DLE)
LINE FEED
RE-TURN
CTRL
A
(SOH)
S
X-OFF(DC3)
D
EOT
F
RU(ACK)
G
BELL
H
BS
J
(ESC)
K
(FS)
L
FORM(FF)
;
RUB OUT
SHIFT
Z
(SS)
X
(CAN)
C
(ETX)
V
(SYN)
B
(STX)
(RS)
N
(SO)
(GS)
M
(NL)
<
,
>
.
?
/
SHIFT
SPACE BAR
REPT

1. INTRODUCTION

The User's Guide is intended to introduce the terminal user to the basic functions of the BTM system. Information is divided into chapters, by subsystem, and presented largely in graphic and tabular format. Simple examples illustrate command usage. For additional information, the user should refer to the BTM Reference Manual (90 15 77).

GENERAL

As indicated in Figure 1-1, on-line services are provided by the following subsystems:

- BASIC processor
- EDIT source file editor

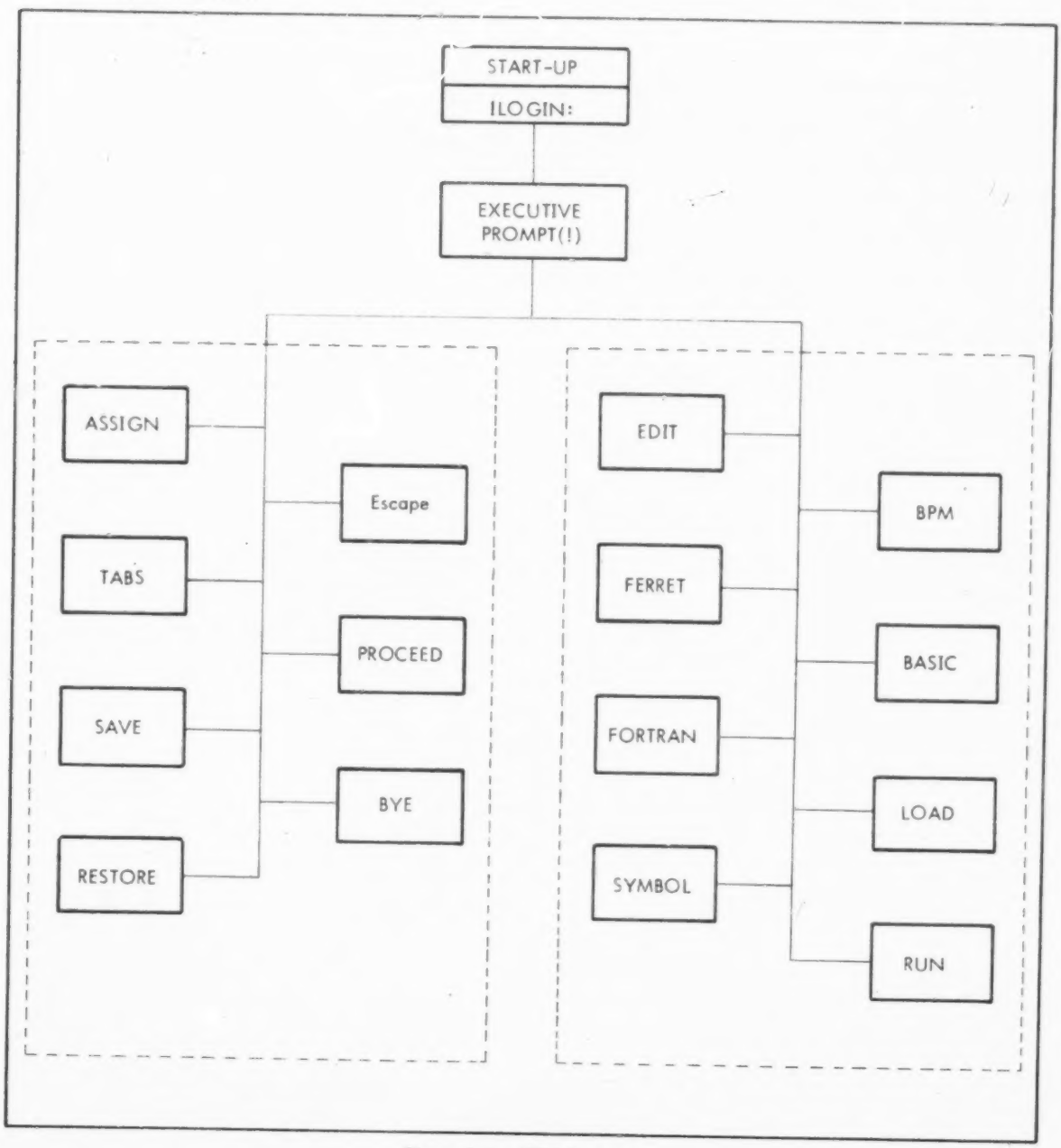
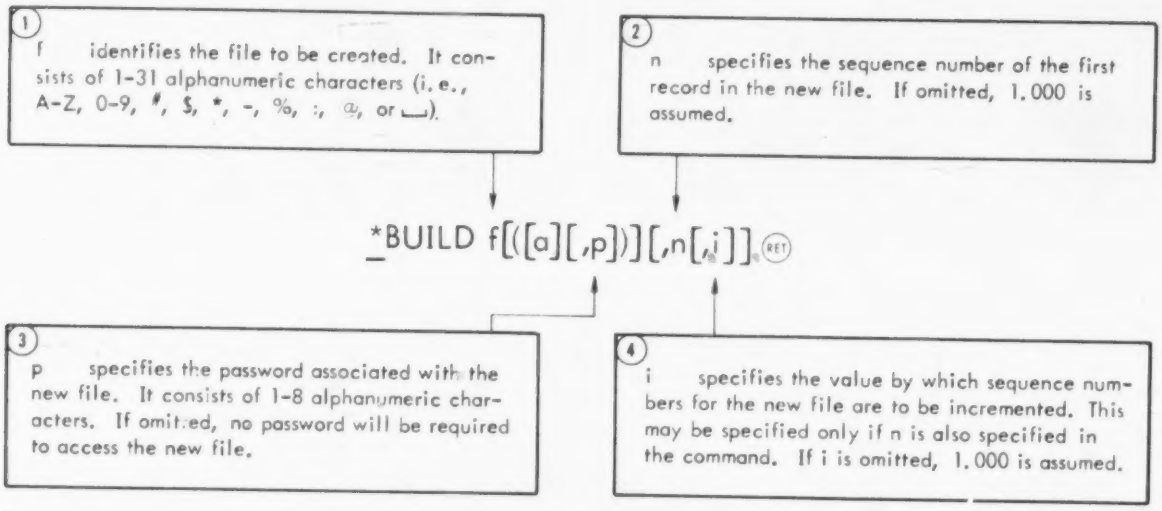


Figure 1-1. BTM System

BUILD (Create a New File)

BUILD causes the Editor to create a new file in disc storage.


1
f identifies the file to be created. It consists of 1-31 alphanumeric characters (i.e., A-Z, 0-9, #, $, *, -, %, :, @, or ␣).
2
n specifies the sequence number of the first record in the new file. If omitted, 1.000 is assumed.
*BUILD f[([a][,p])][,n[,i]]RET
3
p specifies the password associated with the new file. It consists of 1-8 alphanumeric characters. If omitted, no password will be required to access the new file.
4
i specifies the value by which sequence numbers for the new file are to be incremented. This may be specified only if n is also specified in the command. If i is omitted, 1.000 is assumed.

Following the BUILD command, the system prompts by typing a sequence number. The user then types in the first line of the new file. Each line comprises a record of up to 140 characters and is terminated by a carriage return. A null record, consisting of only a carriage return, terminates the action of the BUILD command.

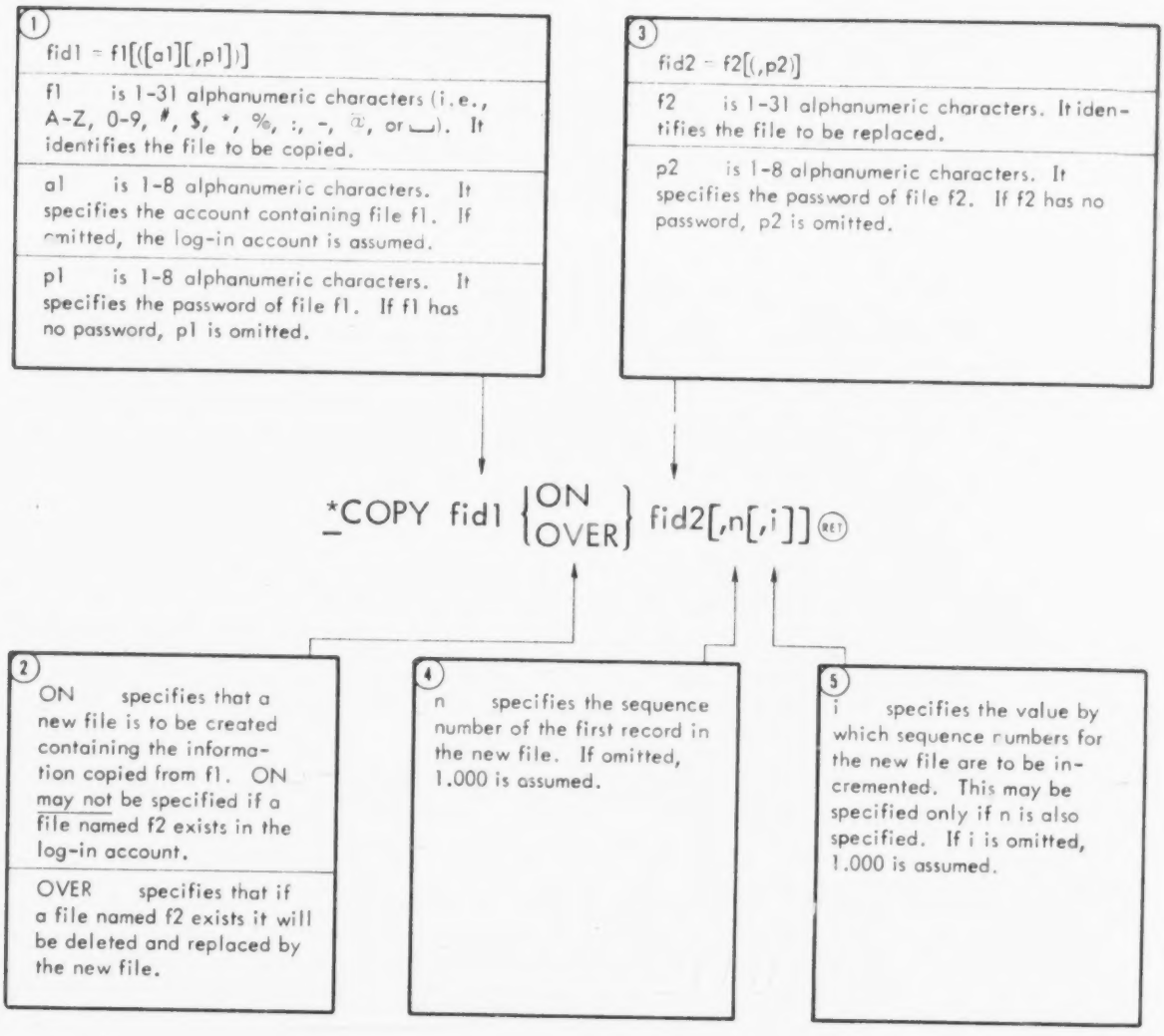
Example:

```
*BUILD ALPHA-RALPHA,10,2
10.000 SYSTEM   SIG7
12.000 DEF      B
14.000 REF      A
16.000 B        A
18.000 END
20.000
*
```

In this example, the user creates file ALPHA-RALPHA comprising five records numbered 10.000 through 18.000 (null record 20.000 does not appear in the file).

COPY (Copy a File)

COPY causes the Editor to copy a specified file.


1
fid1 = f1[([a1][,p1])]
f1 is 1-31 alphanumeric characters (i.e., A-Z, 0-9, #, $, *, %, :, -, @, or ←). It identifies the file to be copied.
a1 is 1-8 alphanumeric characters. It specifies the account containing file f1. If omitted, the log-in account is assumed.
p1 is 1-8 alphanumeric characters. It specifies the password of file f1. If f1 has no password, p1 is omitted.
3
fid2 = f2[(,p2)]
f2 is 1-31 alphanumeric characters. It identifies the file to be replaced.
p2 is 1-8 alphanumeric characters. It specifies the password of file f2. If f2 has no password, p2 is omitted.
*COPY fid1 {ON / OVER} fid2[,n[,i]] RET
2
ON specifies that a new file is to be created containing the information copied from f1. ON may not be specified if a file named f2 exists in the log-in account.
OVER specifies that if a file named f2 exists it will be deleted and replaced by the new file.
4
n specifies the sequence number of the first record in the new file. If omitted, 1.000 is assumed.
5
i specifies the value by which sequence numbers for the new file are to be incremented. This may be specified only if n is also specified. If i is omitted, 1.000 is assumed.

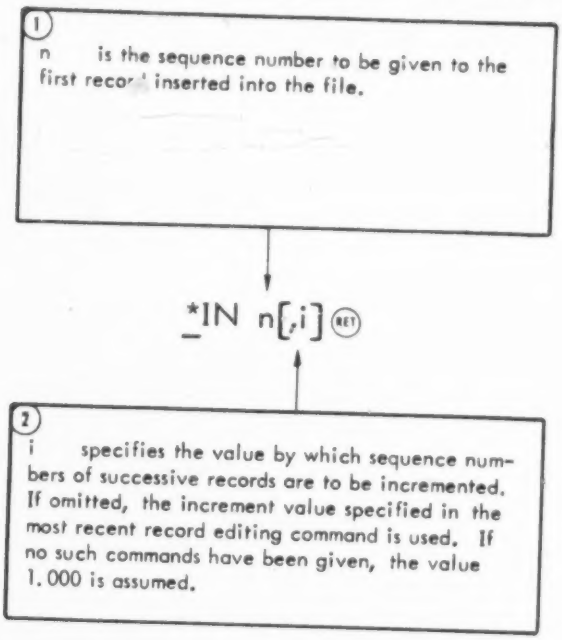
Example:

```
*COPY PELION ON OSSA(,HUSH)↵
..COPYING
..COPY DONE
*
```

In this example, the information from the file named PELION is copied to a new file named OSSA. The password HUSH is associated with the new file.

IN (Insert Records)

IN causes the Editor to insert records into a file that has been opened for editing (via an EDIT command).


1
n is the sequence number to be given to the first record inserted into the file.
*IN n[,i] RET
2
i specifies the value by which sequence numbers of successive records are to be incremented. If omitted, the increment value specified in the most recent record editing command is used. If no such commands have been given, the value 1.000 is assumed.

New records are inserted beginning with record n. If a record with sequence number n already exists in the file, it is replaced by the newly inserted record. Note that existing record n is the only record that may be replaced in this way. If a subsequently inserted record would equal or exceed the sequence number of an existing record, the IN command is terminated and the console bell is rung.

The Editor prompts the user console with the sequence number of each record to be inserted. A null record (carriage return only) terminates the command.

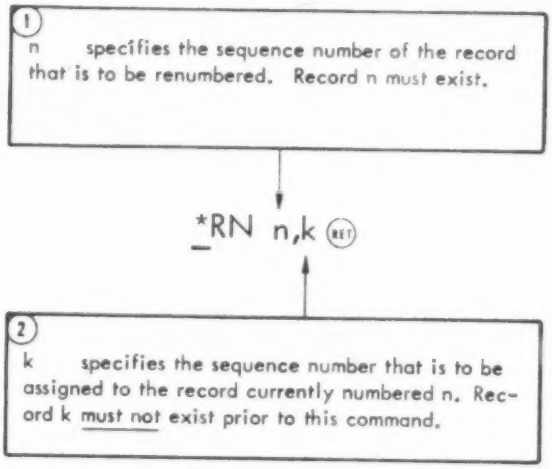
Example:

```
*EDIT ANYFILE RET
*IN 10,.5 RET
10.000 LI,R3 X'F1' RET
10.500 STW,R3 ONE RET
*
```

In this example, existing record 10.000 of file ANYFILE is replaced by a new record typed by the user. New record 10.500 is also inserted into the file. Because a record with sequence number 11.000 already exists, the command terminates and the bell is rung. ANYFILE remains open for further editing.

RN (Renumber Record)

RN causes the Editor to renumber a specified record of the currently open file, deleting it from its old location.


1
n specifies the sequence number of the record that is to be renumbered. Record n must exist.
*RN n,k RET
2
k specifies the sequence number that is to be assigned to the record currently numbered n. Record k must not exist prior to this command.

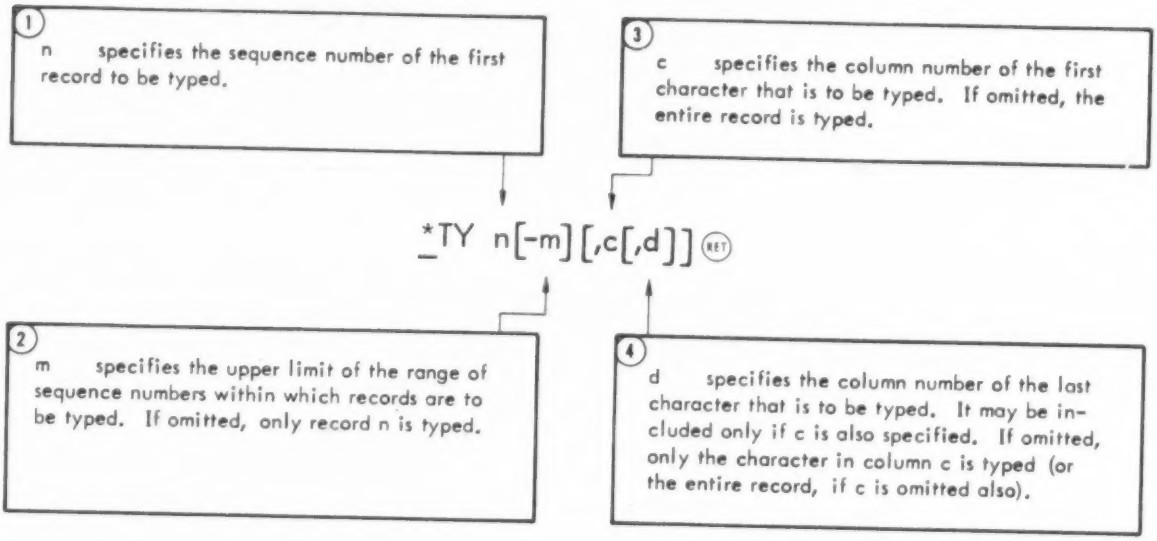
Example:

```
*EDIT THISFILE RET
*RN 10,20.1 RET
*
```

In this example, record 10.000 of file THISFILE is renumbered 20.100 and moved to the corresponding location in the file.

TY (Type Records)

TY causes the Editor to type specified columns of one or more records in the currently open file.


1
n specifies the sequence number of the first record to be typed.
3
c specifies the column number of the first character that is to be typed. If omitted, the entire record is typed.
*TY n[-m][,c[,d]] RET
2
m specifies the upper limit of the range of sequence numbers within which records are to be typed. If omitted, only record n is typed.
4
d specifies the column number of the last character that is to be typed. It may be included only if c is also specified. If omitted, only the character in column c is typed (or the entire record, if c is omitted also).

There is also an intra-record form of this command (see page 5-4).

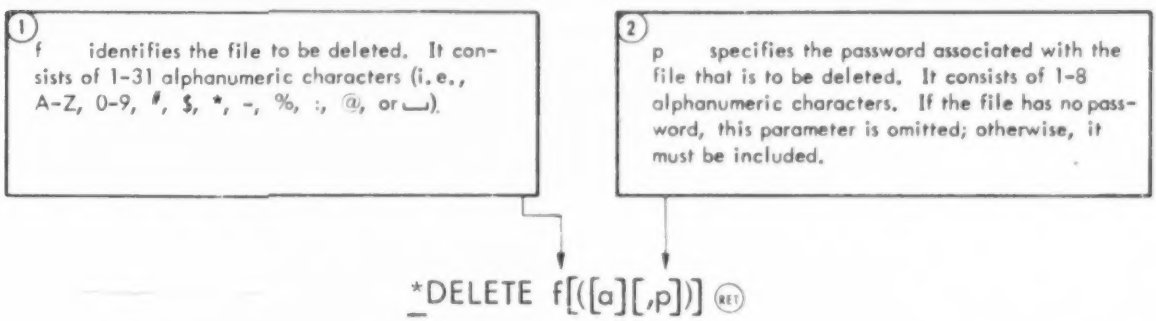
Example:

```
*EDIT SOURCEFILE RET
*TY 1-2,4,8 RET
1.000    EQU
1.200    SYST
1.400    REF
1.600    DEF
1.800    PAGE
2.000    ITIAL
*
```

In this example, the characters in columns 4 through 8 of all records in the sequence number range 1-2 of file SOURCEFILE are typed following the sequence number of each record.

DELETE (Delete a File)

DELETE causes the Editor to delete a specified file from the log-in account.


1
f identifies the file to be deleted. It consists of 1-31 alphanumeric characters (i.e., A-Z, 0-9, #, $, *, -, %, :, @, or ←).
2
p specifies the password associated with the file that is to be deleted. It consists of 1-8 alphanumeric characters. If the file has no password, this parameter is omitted; otherwise, it must be included.
*DELETE f[([a][,p])] RET

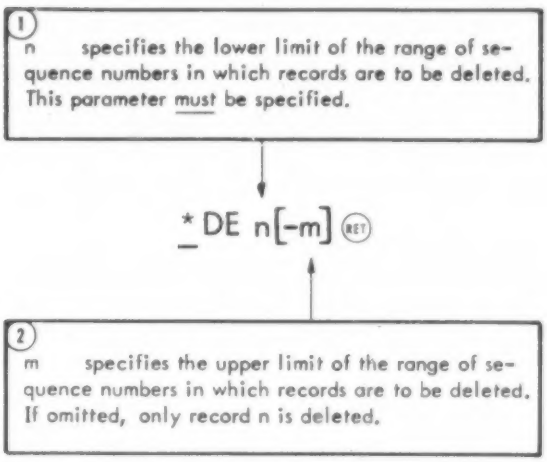
Example:

```
*DELETE SUPERNUMERARY(,COVERT) RET
.. DELETED
*
```

In this example, the file SUPERNUMERARY having the password COVERT is deleted from the log-in account.

DE (Delete Records)

DE causes the Editor to delete, in the currently open file, all records whose sequence numbers lie in a specified range.


1
n specifies the lower limit of the range of sequence numbers in which records are to be deleted. This parameter must be specified.
*DE n[-m] RET
2
m specifies the upper limit of the range of sequence numbers in which records are to be deleted. If omitted, only record n is deleted.

Example:

```
*EDIT SOMEFILE RET
*DE 25-30 RET
*
```

In this example, any records in the range 25.000 through 30.000 of the file SOMEFILE are deleted. The file remains open for further editing.

Section IV
REPORTING

Abstract

The Reporting or final session of the Institute had as its main objective to synthesize the techniques developed in the three previous sessions and from this synthesis would evolve an illustration of the purpose and value of a sound reporting procedure in the demonstrative functions of the institution. The morning portion of this session gave the participants background in reports definition and formatting. The afternoon segment of this session was a lecture on graphics, presenting general techniques and principles for communicating data analyses and reports in a more precise and dramatic manner. The following set of lecture materials contains excerpts from materials developed by the discussion leaders who participated in the morning segment of the Reporting session.[6] We have consolidated these pieces into one to avoid duplication. Guides used for the afternoon graphics session were: (1) "Graphic Presentation", published by the Department of Defense. This handbook serves as a guide for the effective use and economical development of the visual aid as a management tool; and (2) "Making the Most of Charts: An ABC of Graphic Presentation" (Presentations:5) published by the Department of the Navy. This is the fifth in a series of pamphlets designed to provide guidance in the planning, presentation and staging of presentations or briefings, and specifically discusses the presentation of figures (quantities) in graphic form. Both of these documents are available through the U.S. Government Printing Office.

MANAGEMENT REPORTING

by

William Churchill
Andrew Goodrich
Charles Stokes

This discussion offers an organized approach for developing an effective administrative planning and control reporting system at a college. It is not intended to teach specific technical skills, but to examine proven techniques for the successful development and operation of an integrated reporting system wherein unnecessary and wasteful fragmentation within the college is avoided. The approach described is applicable at any college, regardless of what means the college uses to make the reporting system workable--human power, office machines and/or the computer. The approach is presented in five sections: Establishing Goals and Objectives; Developing the System; Implementing the System; Scheduling and Planning; *and* Evaluating and Maximizing Performance.

INTRODUCTION

Too often higher education, perhaps more than any area, operates with grossly inadequate information about its operations and products, about its resource allocation and about the effectiveness of its programs. This is tragic, for with the technical equipment and know-how now available it is within the reach of all colleges to build a network of reporting applications which would bring great improvements in the quality of administrative operations, planning and control of the college.

Such a network, if it is to be optimally effective, is based on three elements:

- *Procedures*--for the collection, manipulation and reporting of information
- *Information arrangements*--for selective dissemination of essential information to each administrator to aid in decision-making
- *Organization*--to facilitate the management and coordination of the information network

For these three elements to effectively co-exist there must be coordinated planning and monitoring of the reporting system.

It must be made clear that this discussion will be phrased in the broadest system sense. The techniques suggested here are applicable at each institution, regardless of what means the institution uses to make the reporting system workable--human power, general accounting machines and/or the computer.

Establishing Goals and Objectives

The ultimate goal of an effective administrative planning and control reporting system must be to completely inform all levels of administration of situations and developments which affect them. To accomplish this goal the following questions must be considered.

1. What data are to be collected?
2. Why are these data created in the first place?
3. What reports are to be generated?
4. Who is to get reports based on this data?
5. Why?
6. How are the reports to be used?
7. When are the reports needed?

These questions must be considered with a view towards:

- Streamlining operations
- Enhancing interaction among functional administrative areas
- Elimination of fragmentation and duplication
- Improved management control and planning

Caution must be taken to avoid the common pitfall of emphasizing immediate benefits--this almost invariably leads to a very limited and shallow reporting system.

Caution must also be taken to promote an *integrated* system wherein all departments may access common information collections, eliminating unnecessary fragmentation and duplication within the college.

Developing the System

To optimize the generation of administrative reports and to assure their most effective utilization the personnel responsible for implementing the reporting system must be precisely aware of the needs of administration for clear and meaningful reports. The counter-productive tendency to tabulate reports which are only the results of massaging raw data without reference to the real needs of administration *must* be avoided. Indeed, no degree of systematized data manipulation, no matter how complicated, can substitute for a well-planned integrated system of administrative reports. Elements necessary for such a system are:

- *Determination of requirements*—to provide pertinent reports
- *Definition of specifications*—to give proper degree of detail to all levels of administration
- *Establishment of integrated data base*—to coordinate information which is organized on a divisional basis in a conventional system
- *Design of modular system*—to facilitate expansion
- *Specification of checks and controls*—to assure security of privileged information
- *Design of forms*—to facilitate data conversion from conventional to integrated system
- *Formatting of reports*—to assure readability and enhance interpretation

The development of the system is not easy for traditional procedures and techniques are deep-rooted, and the attitude of administrators towards information in their purview is too often proprietary. Consequently only under the direction of high level administration are the information specialists able to provide the effective reports needed by individual directors and supervisors.

Implementing the System

After the system has been developed it may be implemented in the following four-step (some steps may be concurrent) fashion:

- Document procedures and detail guidelines
- Train staff
- Integrate files
- Test the system

DOCUMENT PROCEDURES AND DETAIL GUIDELINES

The most important element of a administrative planning and control reporting system is its documentation for the system cannot function as designed unless all involved personnel are knowledgeable about the products, benefits, requirements and procedures of the system. To effect implementation of the system, documentation must first be provided in the form of an administrative manual which details procedures and guidelines for operations.

TRAIN STAFF

The training of staff in offices providing data and using reports from the system is vitally important. The instruction must be geared to level of responsibility of the staff member. The higher the staff member the broader but less detailed the instruction; the closer to individual datum handling the staff member the more specialized and detailed the instruction.

INTEGRATE FILES

Records and files from different offices are not maintained in an uniform fashion. Consequently, techniques for merging and organizing the files to be useful in an integrated system must be developed.

TEST THE SYSTEM

The accuracy of the reports must be assured if the system is to be meaningful and effective. There are commonly two problems in testing the system—the non-availability of a comparison standard and the difficulty in "parallel processing".

On one hand, since an integrated reporting system often provides reports not previously possible, there may be no simple standard with which to compare generated reports. Hence strategies for thorough validity checking of both the data base and the generated reports must be devised.

2

On the other hand, since an integrated reporting system is often pursued to improve quality in a collection of isolated existing reporting systems, there must be a system change-over after the validity of the integrated system is certified. This most often requires a "parallel processing" period, but since such duplicity is usually very difficult to sustain, strategies for rapid, yet thorough, parallel processing must be devised.

Scheduling and Planning

The value of a reporting system is measured by the accuracy and timeliness of its reports. If a system is to be effectively used, personnel working in all units must be required to furnish information quickly and the information group must be required to furnish reports in a timely fashion. Proper coordination of such activity requires the establishment of policy controls and the subsequent development of a schedule for all phases of the system—data collection, manipulation and reporting.

Since diverse demands on the reporting system invariably will cause differences and slippages in idealistically conceived schedules, some individual or committee must be vested with authority to initiate and administer policy, establish work priorities and adjudicate differences.

Evaluating and Maximizing Performance

To be ultimately successful an integrated reporting system, as any other enterprise, should have some method of evaluating its performance. Evaluations should be performed either for specific purpose, periodically or at some checkpoint. Then necessary modifications for improvement should be prescribed and implemented.

A natural question which arises is how is the evaluation to be done and who establishes the measurement criteria. Though this question must be decided by administration or some delegated authority, well-known facets to be considered in evaluating performance are:

- Cost
- Accuracy
- Reliability
- Responsiveness
- Quality
- Usefulness
- Security
- Flexibility
- Efficiency
- User satisfaction
- Acceptability
- Capacity

As a review of the table indicates any evaluation and resulting system modification may use a combination of at least three vantage points:

- *Direct*—Time saved, cost-benefits, etc.
- *Derived*—New applications, return on efforts, etc.
- *Subjective*—Service improvement, morale improvement, etc.

The importance of evaluation and the resulting prescription of modification cannot be emphasized too much. Sound evaluation, with broadly based participation, is necessary for the greatest benefits to be gained from an integrated administrative control and planning reporting system.

Section V
TEAM PRESENTATIONS

Section V

TEAM PRESENTATIONS

TEAM PRESENTATIONS

Three of the many flip-charts displayed in the Team Presentations on the final days of the Institute's sessions, sum up most of the major ideas that surfaced during the Institute, as the teams worked toward their goal of developing a useful management information system. (The three charts follow the narrative below and correspond to the number of the section).

1

As was mentioned before, the concept of a centralized data bank was the primary emphasis throughout each of the presentations. We have chosen to include, one of the flip-charts entitled "Data Bank System", which seems to give a detailed picture of what was envisioned in the idea of a data bank—data coming in from a variety of sources (as well as what *types* of data from these sources) and information going out from the data bank, most often in the form of reports to specific offices within the institution. The "data bank" functions as the operational unit where collected data is manipulated and stored. In some cases—where computer configurations were present at the institutions—this data bank was viewed as the computer center.

2

In another presentation, the team gave a flip-chart diagram of the "Information Flow Procedure". According to this team, this would be the general flow of information using an "Agency" which represents anyone wanting information. It might be the President, one of the institution's departments, a government or community agency, etc. This "agency" would then *request* such information that it needs or wants from a central office within the institution, in this particular case, the team chose the Institutional Research office as the central office where the data bank, previously described, would be located. This Institutional Research office would then have the responsibility of collecting data from the source, related to the type of information requested, and manipulating this data to produce a report(s) which would then be directed to the original agency requesting the information. However, one point to consider here is in addition to the agency receiving the report, this "procedure" functions so that an identical report—manipulated data—is channeled back into the data bank and stored for future use. If similar requests are made in the future by other "agencies", the whole process will not have to be repeated, and in fact, taking into consideration any necessary up-dating, they need only issue another report.

3

The third diagram chosen for review was drawn by a team who, as mentioned before, gave a great deal of emphasis to the business office-type functions.

As you can see, this "Hierarchy of Information Needs" is composed of four (4) levels. At the foundation, we see the centralized data base—a central pool of data collected throughout the university/college that could be made available for various reports. Above this data base, you find three other levels, which feed into the next higher level of the hierarchy. The transactional level, where more specific data is required on such items as student accounts. It was submitted by this team that the decisions made on this level would be programmatic and in most cases, automatic. The next level is viewed as the operations or tactical level, for example, the business office, where the officer would *not* need to know details about every student's account, but he would, most probably, be concerned with those accounts that are delinquent, as well as general information on the account totals. The third and final level would be the policy or strategic level, which is viewed as the highest level of information needs. The president was cited at this level and his needs consisted of a knowledge of such things as a *total* dollar amount outstanding from students' accounts, rather than knowing facts about specific accounts. The structure shows that each level of decision making has access to all the information required to make a decision.

DATA BANK SYSTEM

(TEAM 3)
FIRST WEEK

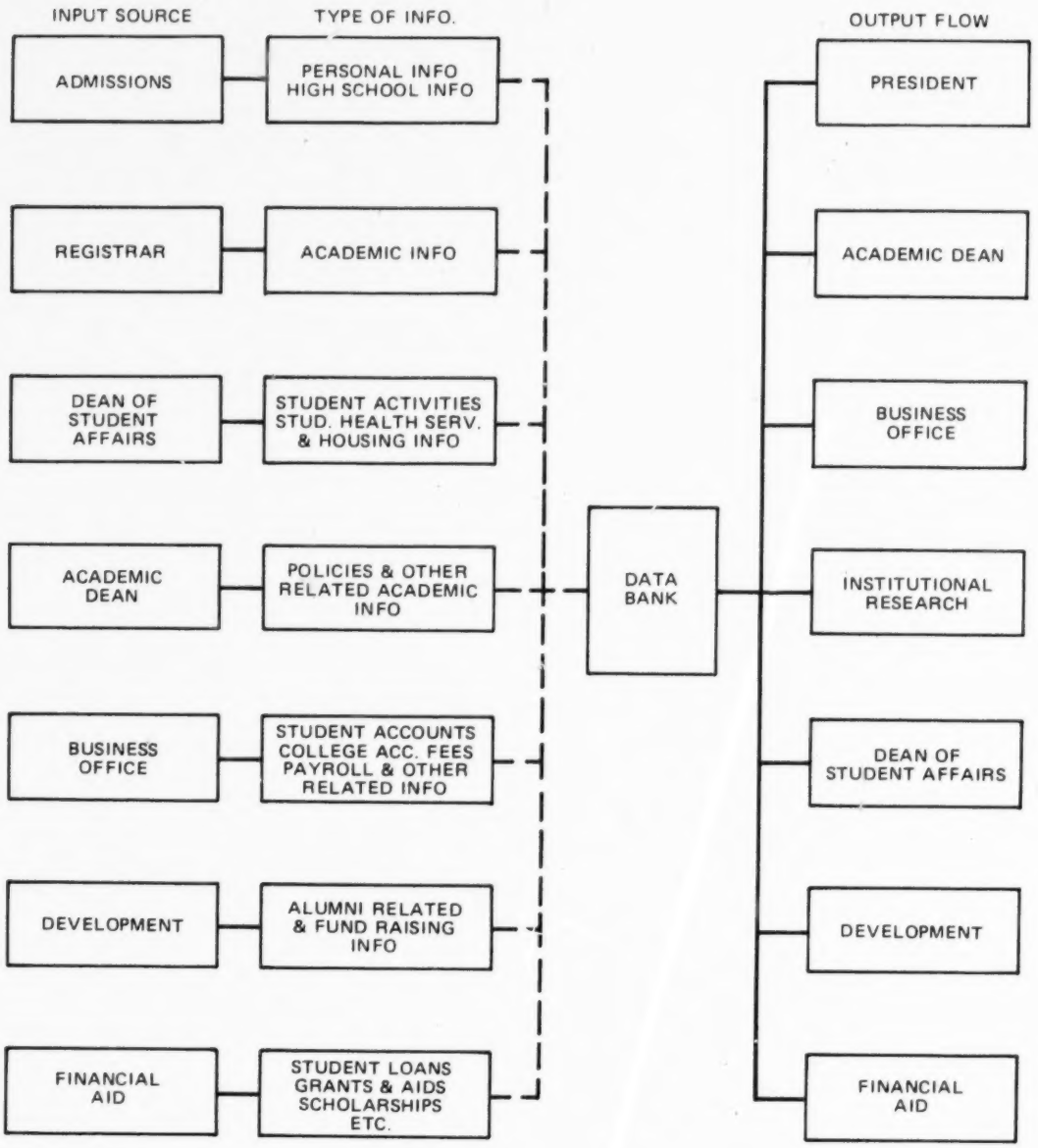


CHART #1

INFORMATION FLOW PROCEDURE

(TEAM 8)
FIRST WEEK

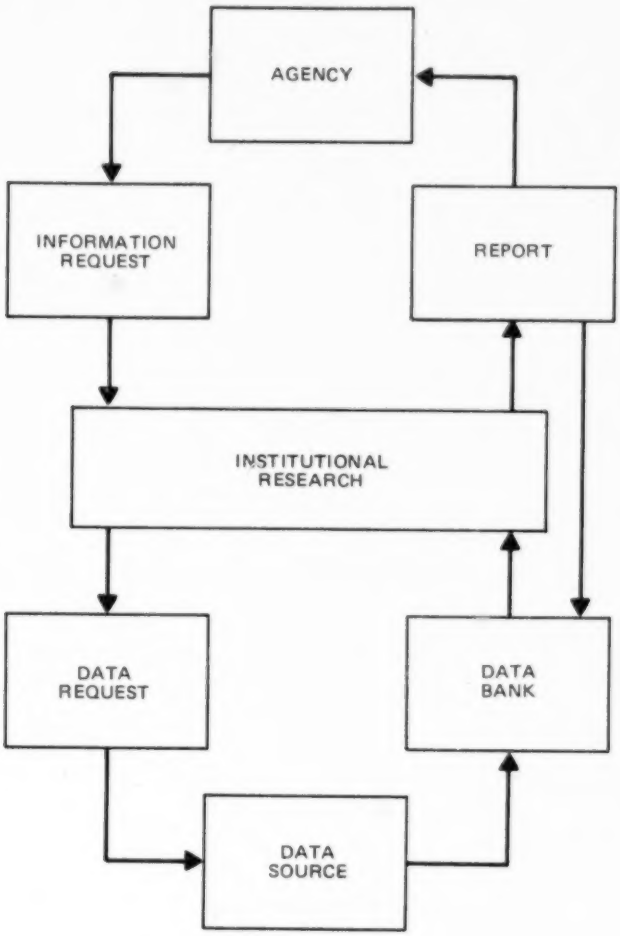


CHART #2

HIERARCHY OF INFORMATION NEEDS

(LEVELS OF SUMMARIZATION)

(TEAM 2)
FIRST WEEK

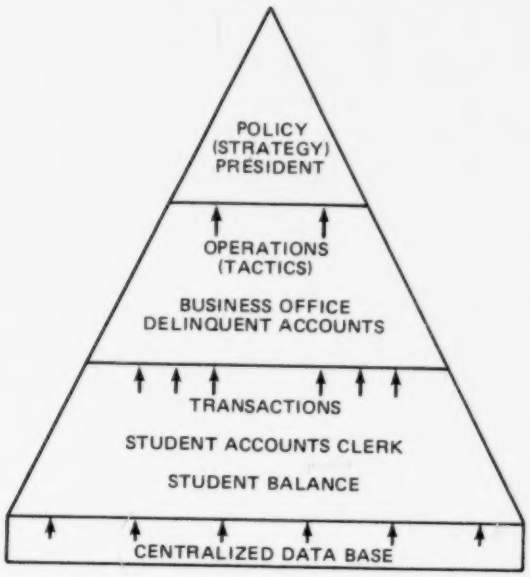


CHART #3

FOOTNOTES

1. Developed by T. McKinney, Director, *Division of Institutional Services, United Negro College Fund*, New York, N.Y.

2. Developed by *Optimum Computer Systems, Inc.*, Washington, D.C.

3. Developed by Clinton Jones, *Fisk University*, Nashville, Tennessee, for the Data Manipulation Session: with the assistance of Charles Chambers, *George Washington University*, Washington, D.C.; Lawrence Lezotte, *Michigan State University*, East Lansing, Michigan.

4. Developed jointly by Charles Chambers, Lawrence Lezotte, and Clinton Jones.

5. Developed by the staff of the *Meharry Computer Center*, Nashville, Tennessee.

6. Developed by William Churchill, Director of Computer Services, *Howard University:* with the Assistance of Andrew Goodrich, Director of Minority Programs, *American Association of Community and Junior Colleges;* and Charles Stokes, Director of the Bi-Racial Study, *Institute for Services to Education, Inc.*